THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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THE MINIMUM WAGE IN YORKSHIRE.

WHATEVER may be the outcome of the strike now proceeding in Yorkshire, one thing is absolutely certain: that unless an end is put to interfering legislation, undertaken by the Government at the instigation of a number of weak-kneed workmen, termed labour leaders—men who do not labour, and who *dare not* lead, even if they could—the coal trade in this country is going to be, if not exactly ruined, at least seriously crippled. So many other industries depend upon the coal trade, that it behoves everyone to take some interest in this question.

Previous to the passing of the Minimum Wage Act, the British miner was the most down-trodden slave on this earth! He was forced down a mine and along a close subterranean passage into a working place and ordered to dig enough coal out to earn his daily wage. If he did not he could starve. The man who was not inclined to work did not exactly starve, but he perhaps had not so much pocket-money as his brother workman who really did work. Why was it that one man had more money than the other? It was because the better-paid man had an easier place to work in—not that he worked any harder. Oh, no! if anything, in fact, the poorer-paid man worked the harder; yet when they changed places, such are the changeful conditions of a coal mine that the places changed too. In other words, an "abnormal" place was abnormal or otherwise depending upon the workman in it. Unfortunately, this tale won a lot of sympathy from the British public and the British Government, and, as a result, the miner got his minimum wage, which, as many anticipated, has proved to be a most demoralising and dangerous experiment in legislation. It is demoralising because it has made the poor workman into a pauper, and as such he is losing the little self-respect he had when he knew his livelihood depended somewhat upon his own efforts; it has made the good workman careless and discontented; and—and this is probably the worst feature of the Act—it is spoiling the youths engaged in the mine, by teaching them that if they only make themselves sufficiently obnoxious to the community they can enforce any demand they care to make. Where is it going to end? In the County of Durham, for instance, the officials of the Durham Miners' Association are not sufficiently advanced for many of the members, who have started what is called a "Forward movement," but which, to give it its proper appellation, is neither more nor less than "Syndicalism," and this party is issuing circulars containing the most foolish twaddle, spreading discontent in both the Counties of Durham and Northumberland.

Much the same thing is happening in Yorkshire, where the present strike was entered upon against the advice of the men's leaders, and at a time when negotiations were in progress. Certainly there ought to have been no strike, and it will be most unfor-

tunate if the owners give way to the demands now being made. It may be given as an excuse that the public are suffering, which is no doubt true, but if things are allowed to go on as they are, the public eventually will be very much worse sufferers than they are now, and it is for the community to give some encouragement to the coal owners who are fighting the battle on behalf of every other industry in the country. What are the facts? In May, 1912, Sir Edward Clarke fixed the minimum wage for the Yorkshire district at 6s. 9d. per day when the basis rate of wages was 50 per cent. above the 1888 standard. Every rise in wages, we may explain, is given as upon this standard, and thus the three successive advances in wages of 5 per cent. each brought the rate up to 65 per cent. above the standard; the monetary value of the three 5 per cents. is 7½d., which added to the 6s. 9d. gives 7s. 4½d. But the actual minimum is only 6s. 9d., and any workman not earning this amount is only entitled to be made up to 6s. 9d. In January last, however, Sir Edward Clarke was asked to revise the position, and taking into consideration that the basis rate was then 65 per cent. above the standard, he fixed a new minimum wage at 7s. 3d. The men had already obtained their rise in wages, but no sooner does the award of Sir Edward Clarke appear, than they take it upon themselves to assume that this is a new basis wage, and that the three 5 per cents. or the 7½d. must be added to the 7s. 3d., and that the basis wage must be not 7s. 4½d., but 7s. 10½d. To us it seems most unfortunate that the question of revising the minimum rate was ever allowed to be raised. The men say that if a man was earning 7s. 3d. a day under the old minimum rate, under the new he gets no advance at all. Of course not, why on earth should he? He receives what he is entitled to receive—a rate of pay 65 per cent. above the 1888 standard, and he cannot receive less than 7s. 3d., and we presume if wages were to drop 5 or 10 per cent. the minimum would still remain 7s. 3d. until this was again revised, but to say that because the minimum rate is raised the basis rate is therefore raised is absurd.

We do not think—though there has been a lot of talk in this direction—that there will be any national stoppage, but the workmen of other districts are keenly awaiting the outcome of this strike, with a view to taking action should the men succeed. Apparently it would appear as though this were an attempt on the part of the men to fix their own rate of wages in addition to the amount of work they shall do for such wages. Truly it would seem as though the day were not far distant when, as predicted by Mr. Hartshorn, the "Syndicalist" leader of the Welsh miners, "the employers shall have no voice in the settlement of wages."

The outlook in the coal trade from a labour point of view is anything but bright, and the coal owners of Yorkshire deserve the moral support not only of every employer of labour, but also of every right-minded citizen in the country.

Cottage Lighting.

Elsewhere in this issue we reproduce, almost *in extenso*, an interesting paper in which Mr. W. Fennell describes his experiences in the endeavour to extend the blessings of the electric light to the humblest class of citizens in Wednesbury, where well-to-do residential consumers are scarce. The results of his experiment are highly satisfactory. The consumers are found to be exceptionally prompt and regular in payment, therein setting an admirable example to their more prosperous fellow-citizens; their load curve is very favourable, as their maximum demand occurs later than the station peak; they apply for connection without the need of canvassing or advertising, and, most striking fact of all, they return a larger rate of profit than any other class of consumer. Moreover, the system has proved successful in spite of the cheapness of the local gas supply.

Mr. Fennell's ingenious methods of reducing the cost of installation deserve commendation; the system of looping-in from an external service wire is, of course, familiar, and other points demonstrated by Messrs. Handcock & Dykes, in their I.E.E. paper some years ago are here again in evidence, such as the unimportance of waste of energy, where it occurs off the peak; but waste appears to be but little met with. The use of a plug and socket as the main switch is unorthodox, but quite unobjectionable, especially as it would rarely, if ever, be employed to break the circuit, and then only a maximum of 120 watts; and the use of screw-capped lamps is a stroke of genius.

One very significant point crops up incidentally in connection with this scheme—the difficulty of introducing the electric light into houses of the class which employs gas cooking stoves. This emphasises the urgent need for the development of cheap and efficient electrical cookers to deal with this class of consumer.

Patents in 1913.

The annual report of the Comptroller-General of Patents for 1913 shows that the applications numbered 30,077, as against 30,089 in the previous year, a slight decrease; completed specifications were 19,309, as compared with 18,853; and patents sealed were 16,599, as against 15,814. Patents expiring in 1913 numbered 15,356. The receipts from patent fees were £307,054, which was £13,525 better than in 1912; the total receipts, including design and trade-mark fees, and sale of publications, amounted to £346,324, which is an advance of £12,857. The total expenditure was £194,423, or £7,417 less than in the previous year. The surplus of receipts over expenditure thus comes out at £151,901, or £20,274 more than in 1912. The Comptroller, in his survey of the year's doings, comments, as usual, upon the trend of invention as indicated by the number of applications received. The motor vehicle industry, as one might expect, has been greatly favoured, the number of applications having increased by 25 per cent. Particularising in this section, it is shown that special interest has been taken in such matters as life-saving attachments or guards, governors for speed regulation, small dynamos for lighting and starting, in devices for preventing starting while the gears are in mesh, and in silent drive or inverted-tooth type of chain gearing. In the same connection, as well as in their application to aeronautics, internal combustion engine improvements have been markedly under attention. Automatic or partly automatic devices for signalling or for stopping railway trains and signalling methods for winding and hauling in collieries, have attracted many more inventors than usual, the former doubtless consequent upon fatal collisions, and the latter owing to recent legislation. A lively interest in the oil industry and a slight falling off in applications relating to textile industry have been among the features of the year, and the Comptroller also remarks that "the continued popularity of the kinematograph is responsible for an increase of 25 per cent. on the previous year, the projection of pictures in natural colours being still the subject of much ingenuity."

The Rubber Position.

The excellence of the demand at the last series of auctions held in Mincing Lane surprised the trade. It had been thought by most people that the heavy quantities which were to be offered (1,350 tons) would have exerted a damping effect upon enthusiasm, but, as a matter of fact, the demand was strong throughout, and prices ruled at a high level all through. The best demand was for the highest grades, while medium and poorer qualities were a bit off here and there. Taken all in all, however, the sales revealed a degree of buying power which came as a surprise. Not only were the quantities offered at auction taken up greedily, but the demands passing in the private market were very large, and substantial business was concluded, while there is still a fair amount doing. It has to be remembered, of course, that the present is the period of greatest consumption, so that a rush of buying was to be expected, and allowance must be made for this; but then, on the other hand, supplies at this time of the year are also very large.

On the whole, a pretty good opinion is mostly entertained as to the prospects for the near future. Recently prices have shown a very encouraging degree of steadiness. Speculative interest has been of a limited character, both here and in the leading Continental centres, while the demand has been practically entirely confined to the trade, and the opinion is held strongly by some of the Continental dealers that the consuming trades both in Europe and the United States are but poorly provided with raw material. It is expected, indeed, that demands will expand in the early future rather than contract, and the outlook is thus viewed with some confidence. The very unfavourable aspect of affairs in Brazil is bound to have an important bearing upon the position of industry along the Amazon and its tributaries, and this cannot but affect the harvesting of the rubber crop, in addition to which the price is so low as to constitute a very serious impediment to the operations of the collectors. The market position is altogether developing soundly, and it is a matter for congratulation that there is not to be any artificial interference with prices by the withholding of supplies.

The chairman of the Straits Rubber Co., in dealing with proposals which had been put forward, stated a few days ago that while he and his co-directors were prepared to support any scheme which in their opinion was calculated to be of genuine benefit to the industry, they would not give their support to any proposals to raise prices artificially by interference with the ordinary law of supply and demand. Without control of production it would be futile to attempt to control prices, and when the necessity arose it would probably be in the direction of reduced supplies that the remedy would lie. The suggestion that a cessation of tapping during the wintering months would be good for all concerned was receiving the closest consideration, and the suspension of tapping for three months would not, he thought, necessarily cause any disorganisation of the labour force, because the coolies could be employed profitably in cultivating the soil, overhauling the drainage system, and doing other plantation work which could not be undertaken during the harvesting months. Any scheme of this kind, however, would require the co-operation of all the planters, because the tappers, as a rule, objected to do any work other than tapping, and, unless the scheme were generally adopted, there would be a danger of those estates which did suspend tapping operations, losing their most expert tappers, which would later place them at a serious disadvantage. In view of the fact that there has been a good deal of overtapping, the proposals seem to be quite reasonable, and conceived in the best interests of the industry, and it only remains to be seen what result will accrue. Temporarily, however, as has been pointed out, such a process of resting the trees must inevitably lead to an increase in the costs of production, though this would be a matter which would, no doubt, adjust itself in due course. It is a little doubtful, however, whether it would in all cases be feasible to employ tappers in the way suggested while the trees were wintering.

Electrical Trade in India.

On another page we publish certain extracts from an American Government report on the possibilities of increased trade in Simla in electrical goods. This report has been drawn up by a Special Commissioner of the American Government who has recently been inquiring into trade conditions in India. It points to a largely increased trade in electrical specialities as a result of the recent developments of electric supply in that city, and contains some valuable information gleaned from various sources on the spot. We would recommend it to the special attention of our own firms, as its publication in America is likely to lead to renewed activity on the part of American electrical firms in India.

Delay in Giving Possession of a Site for Works.

A case which presents some features of interest to those who are concerned with contracts for large works was decided recently in the King's Bench Division. The question was this: If, through the action of a third party, the employer is unable to allow the contractor to commence the work on the day named, with the result that the contractor sustains loss, who is responsible—the employer or the contractor? In the case in question (Porter *v.* Tottenham Urban District Council) (*Times*, December 22nd) it appeared that the plaintiff had contracted with the defendant Council to build a school for them for £11,043. By the fourth clause the contractor was to be at liberty to enter on the premises immediately after signing the agreement for the purpose of executing the works, to begin the work forthwith, and to deliver up the premises fit for use within ten months after the date of the contract, subject to penalties. The site of the school was in a field so situated that access could only be obtained from a road which was separated from the field by a fence. One half of it had not been made up. The soil of the road was vested in the owner of an adjoining building estate. The defendants, to give the plaintiff access to the site, made an opening in the fence and put a gate in it. The plaintiff began the work on February 20th, but on March 6th he received a letter from the owner of the field claiming the right to prevent carts from passing over what he claimed to be his private property, and threatening an injunction. The plaintiff had no alternative but to give an undertaking not to proceed with the work.

Finally, the defendant Council were obliged to begin legal proceedings to obtain an injunction against the adjoining owner on May 11th. It was in respect of this delay (from March 6th to May 11th) that the present action was brought to recover from the defendants the damages caused thereby.

The Official Referee gave judgment for the plaintiff for £560 12s. 6d., holding that the defendant Council were bound, on making the contract, to give immediate possession of the whole site, and that they had failed to do so.

The Appeal Court, however, has reversed this decision, holding that as the employers were not responsible for the delay in the contractor reaching the site, they were not liable to pay damages.

It was contended that the employer was liable for anything that might happen relating to his title to or possession of the site, and that therefore he was liable in this case for the consequences of the interference of the adjoining owner. The Court held that the employer was no more responsible than he would have been if performance of work had been prevented by *force majeure*, or inevitable accident. The case clearly shows the desirability of providing for a contingency of this kind in the clearest possible terms.

THE MODERN MOTOR.

By E. F. BUTLER.

The present day motor, both in design and performance, is a long way ahead of its predecessor of, say, ten years ago.

After a wide experience of most makes of motors, both English and otherwise, the writer has come to the conclusion that room exists for still further improvements, particularly in regard to brush gear, bearings and accessibility. In the advertisement columns of a technical paper recently, about twenty of the leading makes of motors were advertised, and every one supports this conclusion, as a reference to each will show.

A is a motor largely used by a firm of lift makers. Its most objectionable feature is the bearings. They appear to be pressed into position, and it is almost impossible to remove them without damage. The endplates are held in position by means of rods passing through the carcase. This makes the larger sizes very awkward to take apart; further, unless care be taken to mark both the endplate and the carcase—a point liable to be overlooked—the brush gear will not come in the right position. This motor has one rare virtue—it is accessible.

The worst feature of B is the brush gear. The brush holders are of the claw type, with the brushes gripped at the end. They are mounted on a spindle bent at one end to a right-angle, and then at right-angles again, forming a crank. This crank is covered with insulating material and clamped in the rocker. The simplest way to regulate the tension on the brushes is to move the crank. This moves the brushes out of the correct position and also alters their bedding on the commutator. The leads are brought into the motor under the bottom of the endplate, and connected to terminals fixed therein in such a position that oil, dirt, and carbon dust fall on them. The endplate on the driving side is cast solid without any openings. The good point of this motor is the bearings, which are first-class both in fit and material.

In C the brush gear completely covers the openings in the endplate, cleaning and adjusting being almost impossible. The field coils are held in place by pole tips fitted with countersunk screws; so that to remove a field coil it is usually necessary to rig up a ratchet drill fitted with a screwdriver in place of a drill, often a lengthy job on outside repair work. To examine the oiling arrangements a small hole is provided, usually fitted with a set screw. With difficulty the ring can be seen, the quantity of oil can only be guessed at.

D is a very good motor. Even in 70-H.P. sizes, however, the carcase is cast in one piece, and this makes the removal and replacement of the armature awkward. Two terminal boxes are provided, and the armature and field wires festoon round the outside of the machine and into these boxes. A much neater and safer way would be to take the leads through the carcase and straight into the terminal box.

E is of Continental origin. The plain shunt type is very accessible, but the interpole type is crowded, and sometimes a permanent resistance in series with the field is tucked away inside the carcase. A very bad feature of this motor is the driving end of the shaft, which is of the same diameter throughout. If the journal gets worn, or scored, and has to be turned down, the pulley, or pinion, must be bushed. If the bearing portion only was larger it could be turned down without affecting the remainder, and the bearing, in this case white metal, could be run up and bored out to suit.

F comes from the North, and in the larger sizes is a good motor. The smaller sizes, however, have one bad fault; in the brush gear no radial adjustment is possible. When new the brush-holders form an acute angle to the commutator, and the brushes cover several segments. As the commutator is turned down, the holders must be twisted around the spindles until, finally, they are at right angles to the commutator and only cover about half the original number of segments. This could be avoided by making the holes for the spindle bushes slotted instead of circular, thus allowing the holders to "follow up" when the commutator is reduced in diameter.

G is noted for the number of new types that appear. Of ordinary plain shunt motors, seven different types are in use in one works. In what appears to be the most used type, the carcase is split and the halves are held together by means of set screws, the heads of which fit snugly into recesses. To turn them it is necessary to use a special box spanner with very thin sides to fit the recesses. The recess, or seating, for the commutator end endplate is made sufficient in diameter to admit of the armature being removed without lifting the top half of the motor. But the brush rocker is cast in one piece, and is too big to come out first. As a consequence, if the motor is gear driven and the top half cannot be lifted, it is usually necessary to remove the driven shaft or else to slew the motor round. The simple expedient of casting the rocker in halves with lugs for bolting together would obviate all this, and enable repairs to be made in half the time.

H is notable for the ease with which it flashes over. One type of brush holder consists of flimsy stampings, tension being applied through a stamped worm and wheel. One flash-over usually settles the lot. Some time ago I noticed an emery wheel driven by such a motor. The whole of the brush gear was covered with insulating tape, as a make-shift to keep the machine going.

I has the pole tips held on by means of countersunk screws through the face. These sometimes work loose and damage the armature. In the larger sizes, the base is much too small, the 70-H.P. size being only two inches wider than the 15-H.P. size of another make. I once came across a watertight crane motor by this firm. The armature leads were brought through watertight glands in the bottom of the motor and cut off to exact length, no provision being made for moving the brush gear. When the bottom brushes required attention, it was necessary to cut the brush leads in order to turn the rocker.

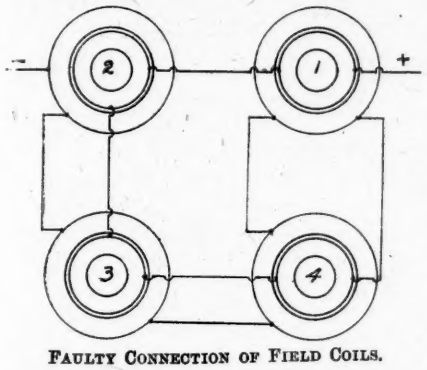
In the smaller sizes of J it is not possible to alter the pressure on the brushes, and it is practically impossible to clean the commutator even with the block of wood supplied for the purpose.

K is fitted with claw type brush holders. To alter the pressure on the brushes takes ten minutes. It is necessary to remove the commutator end covers, take off the top of the terminal box, remove the "line" and armature cables, also the brush leads, take out two set screws holding the rocker in place, pull the rocker round, and then, if the special spanner supplied for the purpose is not lost, the pressure can be altered.

L is much advertised in small sizes. In a number I have seen, the brush spindles are brought through the endplate and the leads connected to the ends, no attempt being made to cover up the live metal, even on 480 volts. A few months ago the writer came across a motor of about 15-H.P. by this firm, the fields of which call for notice. Each coil was in two portions, an inner one fitting on to the pole piece, and an outer one large enough to slip over it. The coils were connected up as shewn in the diagram, p. 605. It will be noticed that nearly the full voltage of the supply is across the coil marked 2.

M is by one of the largest makers in the world. The means of altering the pressure on the brushes is crude. The inner end of a spiral spring is squared

and fits on to a squared spindle. The outer end presses on the brush. To increase the pressure it is necessary to move the spindle through a quarter turn. This puts too much pressure on, and further adjustments have to be made by means of a pair of pliers, to the outer end of the spring. In the traction motors of the same firm, the square spindle has a wheel which gears with a small worm, slotted at the top to fit a screwdriver. This is an ideal arrangement, as the pressure can be adjusted to a nicety, or



Faulty Connection of Field Coils.

the spring held clear for changing brushes. In the ordinary shunt motor the field coils are connected together by several very fine wires, quite strong enough electrically, but weak mechanically, and easily damaged, also inconvenient for testing out.

N is another very old make. The earlier machines were most awkward to take apart, as the feet of the motor were cast on the endplates. The present types are much better, but the leads are brought out from holes drilled in various parts of the carcase. Also the gauze covering the openings in the endplates is held in place by screws fixed inside, impossible to get at and dangerous should they work loose.

O is like the curate's egg—good in parts. The brush gear is distinctly poor and of the claw type. The copper strips for shunting the current from the springs get broken off after the brush has been lifted a few times; flexible pigtails should be used. The field coils are very inaccessible, it is impossible to get to the connections, even in the 70-h.p. sizes. The strong point of this make is its commutation. I have in mind a 70-h.p. working on 480 volts and taking 250 amps. without a spark at starting.

Most of the machines mentioned are by the leading makers, and the article is not written in any spirit of complaint, but to indicate the lines along which further improvements may be effected. The designer usually knows and does his work well, but as a rule suffers from lack of operative experience. Let him, when designing a machine, carry out mentally a few simple operations, such as:—disconnect quickly each field coil for individual testing, fill the bearings with oil when the motor is mounted upon a ceiling or inverted, change a set of brushes, clean the inside of a motor from the driving end, tighten up any of the lower pole pieces.

Finally, it would be very convenient if makers would stamp the value of the shunt current on the name plate as a guide for wiring and also the selection of control gear; the best English starters are turned out by a firm that do not make motors.

Liverpool.—Proposed Tramway Goods Traffic.— The City Council has referred back the resolution of the Tramways Committee that the general manager be instructed to enter into negotiations with other tramway authorities with the object of inaugurating a service of one or two motors and trailers for the conveyance of goods. It was agreed, however, to communicate with the Dock Board as to the congestion at the Docks, and to report to the Council on the result of the negotiations.

SUPERHEAT.

By "WHISTLEFIELD."

It is generally recognised that the use of superheated steam raises the efficiency of turbines as well as reciprocating engines. This increase in efficiency is greater than one would expect from a consideration of the heat diagram of expanding steam, so that the cause for the improvement has to be sought in other directions. Figure 1 represents to scale the temperature entropy or heat diagram, for a pound of steam which has been expanded from an absolute pressure of 200 lb. to an absolute pressure of one pound, or a vacuum of 28 inches.

When this expansion takes place the temperature of the steam falls because its heat is being converted into energy, and, if the steam was saturated to begin with, a gradually increasing quantity will condense.

If, on the other hand, extra heat is imparted to the steam as it expands to maintain its temperature constant, no condensation will take place. This expansion at constant temperature is known as isothermal expansion, and is represented by the line C D, but the expansion with falling temperature, that is with no heat either imparted to the steam or extracted from it, is known as adiabatic expansion, and is represented by the vertical line C E. Should heat be taken from the steam during its expansion, by radiation from the cylinder walls, or other similar causes, the expansion will be represented by the dotted line C N, the slope of this line depending on the rate at which heat is being lost. If we consider the expansion of dry steam, without any superheat and without any loss due to radiation, from an absolute pressure of 200 lb. to a vacuum of 28 inches, the amount of heat, and therefore of work, which can be usefully employed is comprised in the area A B C E, and the thermal effciency would be the ratio of the area A B C E to the area H A B C E K.

The area A B C D represents the work that would have been done by the steam had no condensation taken place, so that the area E C D represents the energy lost due to condensation. At the end of the expansion therefore the length of the line A E represents the weight of steam and the length E D represents the weight of water derived from the original quantity of steam.

By superheating the steam from a temperature of 381 degrees Fahrenheit (the temperature of saturated steam at an absolute pressure of 200 lb.) to a temperature of 531 degrees Fahrenheit (150 degrees of superheat), we add the area E C F G to the area of useful work represented by A B C E, but the gain is only apparent because we have also added to the quantity of heat which passes on to the condenser the area K E G L, so that the thermal efficiency now stands as the ratio of the area A B C F G to the area H A B C F L.

Though this gain in thermal efficiency is only very slight, nevertheless there is improvement in other directions, and turbine makers reckon on an average of one per cent. increase in efficiency for every 10 degrees of superheat. Superheat means that there is a lower percentage of moisture in the steam, the length G D now representing the amount of water at the end of the expansion. With saturated steam condensation commenced immediately the expansion took place, but with superheated steam no condensation begins till the line F G has crossed the steam curve C D, so that during the earlier part of the expansion the steam was quite dry.

D

It has been proved by experiment that wet steam flows through narrow passages far more readily than dry steam, so that the benefit of using superheated steam at the high-pressure end of the steam engine where there are possibilities of leakage past valves and ports is evident.

When saturated steam enters a cylinder, a good deal is wasted because it condenses. The metal surfaces that the steam comes in contact with are colder than the incoming steam because they have just been in contact with the exhaust steam at a much lower temperature; this condensation is in addition to the normal condensation which takes place because of the expansion, and greatly increases the skin friction between the piston and cylinder, besides doing no useful work because the water cannot expand. Superheated steam would have been cooled also for the same reason, but it carries surplus heat which it can give up without causing itself to condense, and the walls, if wet, would probably be dried so that not only is condensation loss eliminated, but sometimes the water on the cylinder walls is evaporated.

It is a well-known fact also that wet metal surfaces conduct heat away far more readily than dry metal surfaces. Even the labourers who work in sugarhouses are aware that the tea cans which they place on hot plates will come to the boil much quicker if they spill some water on the plate and stand the can in the pool. Saturated steam keeps the cylinder walls perpetually covered with a film of moisture, and thus causes a far greater loss by radiation than superheated steam would have done in spite of its higher temperature. We see from

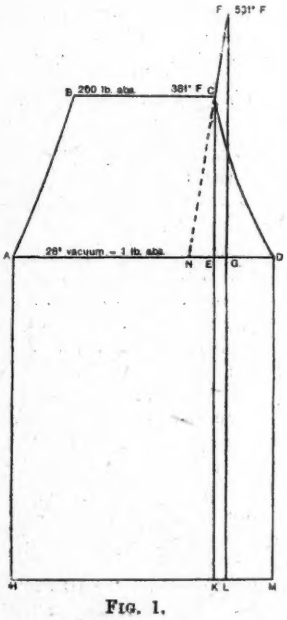


Fig. 1.

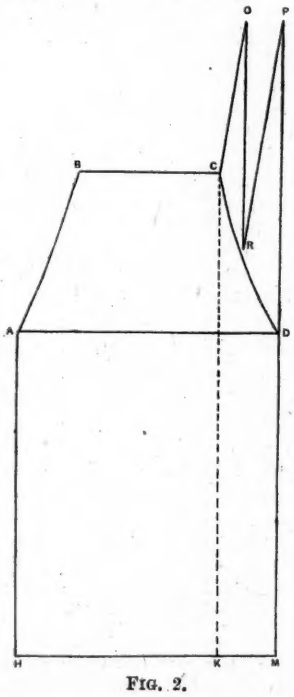


Fig. 2.

the dotted line C N in figure 1 that the radiation loss is capable of cutting off a good deal of the useful heat area.

These considerations would seem to show that the use of superheated steam improves the efficiency of reciprocating engines by reducing skin friction, initial condensation and radiation losses, thereby enabling the performance to approximate more nearly to the theoretical efficiency than the use of saturated steam is able to do. In the early days of the steam turbine, Mr. Parsons arranged for live steam to be admitted at various points in the turbine to maintain the steam dry throughout its expansion.

The result was that the area E C D in figure 1 was added to the heat area, which was usefully employed when saturated steam was used. The actual thermal efficiency, however, was reduced by this arrangement, because the area K E D M was added to the lost heat area H A E K. By actual measurement it will be found that the thermal efficiency represented by the area A B C D to the area H A B C D M is less than the thermal efficiency represented by the ratio of the area A B C E to the area H A B C E K.

In spite of the fact that the thermal efficiency was less for this isothermal expansion than for the adiabatic expansion of saturated steam, the extra heat supplied produced an improvement in the turbine efficiency, due in this case also to the fact that the dry steam enabled the turbine performance to approach more closely to the theoretical result than wet steam was able to do. With turbines the wetness of the steam acts somewhat differently than in the case of reciprocating engines.

Instead of skin friction on the cylinder walls, wet steam produces friction on the blade surfaces. As the blade area in turbines is very large, the loss due to this water friction is a serious item. Initial condensation due to differences between the temperature of the steam and the temperature of the blades is not very great because the expansion of the steam takes place in far more stages in the turbine than in the reciprocating engine, so that the fall of temperature in each stage is small. Another effect of superheating steam is to increase its volume as compared with saturated steam under the same pressure, for we know that the volume of a gas at constant pressure is proportional to its absolute temperature. At a pressure of 150 lb. by gauge, the temperature of saturated steam is 366 degrees Fahrenheit, or 827 degrees absolute. If this steam is superheated to 560 degrees Fahrenheit, or 1,021 degrees absolute, its volume will be increased by more than 22 per cent.

In the high-pressure end of a reaction turbine, the length of the blades is very small, because the sectional area of the drum on which these blades are mounted must be kept fairly large to ensure rigidity, and the volume of the steam used is comparatively small. This means that the blades are sometimes not more than three-eighths of an inch long, and the area of the clearances at the blade tips bears a large ratio to the blade area. An increase of over 22 per cent. in the volume of the steam used means that the blade lengths can be appreciably increased, so that a large reduction is made in the proportion of steam which leaks past the blade tips without doing useful work.

In impulse turbines where the pressure of the steam is changed into velocity by expansion, superheat reduces the quantity of water which is formed during the expansion, and so reduces the blade friction.

In order to eliminate water completely from the steam, Dr. Ferranti has designed a turbine in which superheated steam is used; after the first expansion and before all the superheat has been exhausted, the steam is resuperheated before doing its work in the next stage.

Figure 2 shows the heat diagram for this method of working. C D represents the dry saturated steam curve, the initial superheat carries the diagram to the point O, the subsequent adiabatic expansion brings the area down to R, then further superheating and expansion produces the area C O R P D. While this heat area produces only a slightly better thermal efficiency than that of saturated steam, the improvement in turbine efficiency is remarkable, and is due entirely to the dryness of the steam throughout the expansion, which enables us to obtain a closer practical realization of theoretical conditions than is possible without superheat.

NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

The town of Galt, Ontario, together with other surrounding places, is trying to induce the Grand Trunk Railway to electrify the branch which runs to Elmira. It was recently reported that gas-electric cars would be put into service in about a month.

Every week almost sees a new set of towns and villages trying to impress on the Hydro-Electric Power Commission of Ontario the advantages to be gained by running an electric railway through *their* district. The Dominion Government will be asked to grant the usual subsidy ($6,400 per mile) for any such railways as may be constructed by the Commission.

Extensions are to be made to the following street railway systems: Saskatoon and Regina in Saskatchewan, Fort William in Ontario, and Lethbridge in Alberta. An electric line is proposed to connect Thamesville and Sombra, one to run from Galt to Hamilton, another to run from Guelph, through Hespeler, Preston, Galt and Brantford, while the Mount McKay and Kakabeka Falls Railway Co., which operates in the Fort William district, proposes to electrify its road and carry out extensions, the power for which would be obtained from the Kaministiquia Falls Power Co., at any rate at the combeing visited at the present time.

A committee has recently been formed under powers granted by the Legislature of Nova Scotia to inquire into the application of electricity in the coal mines of the Province. This Commission is expected to report this summer; various mines are being visited at the present time.

Anyone who has visited Niagara Falls will know what pains have been taken by the Queen Victoria Niagara Falls Park Commission to make beautiful walks and lawns on the Canadian side of the river. This year it is probable that a magnificent greenhouse will be built close to the brink of the Horseshoe Falls, and some 17 acres of land close to the Brock Mountains will be laid out to form part of the splendid park system which at present reaches from the power houses to the suspension bridge, and will some day probably be continued right down to Queenstown.

The Dominion Government has recently decided to purchase the site on Long Cove, Esquimault, B.C., for the construction of a new dry dock capable of accommodating the largest ocean liners afloat; the cost will be about £800,000. No doubt there will be some electrical work in connection with this scheme.

THE ELECTRIC LIGHTING OF COTTAGES.

By W. FENNELL, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers at *Birmingham, March* 25th, 1914.)

Electricity has for so many years been looked upon by the public—and even by electrical engineers themselves—as a very convenient but rather expensive form of lighting, that it requires considerable imagination, even to-day, to contemplate the installation of electric light in hundreds of cottages inhabited by the poorest people and rented at, say, 3s. to 4s. per week.

Wednesbury, like many Midland towns, is not an attractive residential area; the richer people for the most part live outside, and the workers form nine-tenths of the population. In developing the demand for electricity on the usual lines, most of the larger houses and shops were soon connected. Reduced rates for licensed premises brought almost all these houses on the mains, and the smaller shops followed when a free-wiring scheme was introduced; but not even free-wiring coupled with the rateable-value system of charge, or slot meters, induced the £8 to £18 householder generally to take a supply of electricity. With these small consumers, the convenience of gas for cooking, and the cheapness of the apparatus, are greatly in its favour.

At first sight it seems to be hopeless, having failed to reach the lower middle class, to look to the class below—the labourer, living in a cottage. It was, however, obvious that if this class could be catered for, a very large new field would be opened. In these cottages the gas stove offers no attractions; a fire is always burning in the living-room, the stove provides hot water and has a good oven. Lighting only is required; but not only "free wiring," but free lamps are essential.

Slot meters being out of the question, and quarterly accounts quite impossible, the author considered the possibility of establishing a weekly payment system. He therefore consulted a local tradesman doing a large weekly payment business. The report was practically as follows:—

"The poorer people are the best class of payers. A debt of only one or two shillings is a worry to them, and they will pay much better than the lower middle classes who have more assurance. It will be found that they are more easily pleased and are anxious not to give trouble; and as they are accustomed to weekly payments for rent, clothes, and furniture, they usually set aside their money regularly for this purpose before spending the balance."

In view of this very favourable report, the author felt safe in adopting a weekly payment system for electricity, and the following is a summary of the arrangements adopted.

These small houses are in blocks, and one service will supply from 5 to 15 houses. The plan adopted is to put an ordinary 7/18 S.W.G. service into the most convenient house, terminating it in a service fuse. From the fuse a twin lead-covered cable is carried either inside or outside the houses, along the row, and is looped into each house to be supplied. If any house in a row is not to be connected, a loop is left in the wire ready to insert when the tenant decides to come on, which is almost certain when a change of tenancy occurs. The cost of the service averages 15s. per house, whereas the cost of an ordinary service for a few lights is about £3 8s. The saving in capital charges is therefore very considerable.

Each house is provided with a wall-plug socket, which takes the sub-service wires; the plug itself is connected by means of flexible wires to a pair of bow cut-outs. This arrangement provides a double-pole fuse and switch ample for disconnecting a 120-watt installation, and is cheaper and less liable to corrosion, etc., than an ordinary double-pole switch. The wiring, which commences at the bow cut-out, is quite ordinary and requires no comment.

The cost of the wiring and fittings without lamps averages £1 10s. to £1 13s. 6d. per house. A local switch is at present allowed for each light, but the substitution of key-holders is being considered. Experiment is necessary to see whether the extra consumption due to the absence of easy switching is of more importance than the reduced cost of wiring.

Three lamps are supplied, two being 40-watt metal-filament lamps (one for each of the downstairs rooms), and one an 8-c.p. carbon lamp for the front bedroom. There is no demand for light in the other bedrooms.

To prevent any but authorised lamps being used, the simple expedient of using Edison screw caps and lamp-holders is adopted. This has been quite effective; lamps with this cap cannot be bought in small quantities, yet there is no extra expense for either holder or lamps. The only screw lamps stocked at the works are 40-watt metal-filament or 8-c.p. carbon; no mistake can therefore be made. When lamps are supplied free of charge it is unlikely that consumers will buy lamps by the dozen in order to defraud the supply authority. The weekly visit of the collector also acts as a check.

The charges must cover the cost of supply of electrical energy, free wiring, lamps, repairs, and the expenses of collection. It was estimated that an average of about 7½d. per week per house would easily cover the cost. The cost of supplying electricity at Wednesbury is, including all charges such as interest on and repayment of loans, £7 per kilowatt of maximum load on the power station plus 0.35d. per kilowatt-hour. These figures leave a small margin. The assumption was made that the absence of a meter would mean a certain amount of waste, so a fairly high average consumption has been taken, viz., 6 hours' use of the maximum demand per night throughout the year. It was assumed that the average maximum demand at the time of the peak load, which is between 4 and 5.30 p.m., would be 50 watts; but experience has shown this to be rather too high a figure. The lamps in use are easily counted, without calling at the houses, by taking note of the illuminated windows. Visits show that the number of lamps in use between 4.45 and 5.30 p.m. amounts to 108 per 100 cottages. Later on, after tea, the demand is higher, but that does not matter, because the power load must be "off" when the workmen and women are at home. One is therefore certain of a high diversity factor for this demand.

Based upon a peak-load demand of 45 watts per house, and a 6 hours' use of this load per day, an annual consumption of 100 units is obtained. The cost of electricity supply is 5s. 6d. per annum for the standing charges, and 2s. 11d. for the energy consumed, or a total of 8s. 5d. The revenue at 7½d. per week amounts to £1 12s. 6d. per annum. The 7½d.-per-week average income is obtained as follows: June and July 5d., May and August 6d., April and September 7d., March and October 8d., February and November 9d., January and December 10d., so that consumers pay approximately in proportion to the use at different times of the year, and new consumers may—and do—start taking current on a fair basis at any time.

Collection is carried out on a commission basis, which has

been found to be satisfactory. A collector working insurance or other business is engaged, and he knows how to deal with these consumers. Payment is made in advance on the Monday or Tuesday, and the consumer is liable to be cut off on the Monday following a failure to pay. A copy of the application form is given as an appendix to the paper.

The scheme is extremely popular; it has grown from an experimental 25 consumers to 250 within 18 months, and this without any canvassing or pushing. It is quite usual for a poor woman to call for a few forms, say a dozen, and to bring them back again signed within a week. Gas is 1s. 11d. per 1,000 cubic feet, so that it cannot be said that dear gas is the cause of the success of the scheme. The actual experience obtained with regard to the following points is of great importance:—

Arrears keep fairly steady and are on an average about equal to one week's rental. Lamp breakages do not average one lamp per socket per annum. Empties are no more numerous here than in other premises, and further, those houses fitted with electric light are sought after.

Although consumers are in no way bound to continue the supply for a definite period, there have been very few permanent disconnections, certainly not more than 2 per cent.

Bad debts can be kept as low as desired; payments are made in advance. Even with fairly lenient treatment the bad debts have not exceeded 1 per cent.

There are several causes which tend to check waste. The first, and perhaps the greatest, is the sense of fairness which exists in the working class, and the second is the weekly visit of the collector. The consumers live in blocks, and the doings of any one tenant are known to all, so that one person at least will report waste. As a matter of fact, the energy consumed costs so little that any possible waste can be ignored. The important point is not waste of energy, but excess maximum demand. This is easily observed, and it has been shown that it does not occur.

The revenue account works out as follows:—

			Per	Ann.
		s.	d.	s. d.
Electricity—				
Kilowatt charge (45 watts at £7 per KW.) ...		5	6	
Unit charge (100 units at 0.35d.)		2	11	
				8 5
Lamps—Two metal-filament and one carbon				4 3
Repairs				1 0
				13 8
Income—52 weeks at 7¼d.	1	12	6	
Less commission, 7 per cent. ...	2	4		
Less bad debts, etc., 3 per cent. ...	1	0		
		3	4	
				1 9 2
Profit per consumer				15 6

The word profit here means surplus after paying all charges, including interest on and repayment of loans for machinery and mains. If these interest charges were based on the cost of extra plant and mains instead of on the old costs, the result would be even more favourable.

We may take half the profit, say 8s. per annum, and use it to write off the entire cost of wiring in four years, leaving a balance of 7s. 6d. net profit per consumer per annum for four years, and 15s. per annum afterwards.

In conclusion a net profit of 7s. 6d. per annum per consumer, or about 25 per cent. of the income, after paying all expenses is a far better return than can be shown on any other class of consumers. Putting it another way, 1 kilowatt of maximum demand produces a profit of over £9 per annum, and over double that sum after three years. Many of the ordinary consumers barely produce a gross income of £9 per kilowatt of the peak demand, to say nothing of profit.

Discussion.

Mr. R. A. Chattock (Birmingham Corporation) thought Mr. Fennell's scheme for lighting cottages of very low rental was ingenious and simple. He confined it to the very poorest people, and indicated that honesty tended to disappear as people rose in the social scale. While agreeing that a scheme of this kind was probably quite workable for a concentrated community, where personal touch could be maintained with the consumer, he was afraid that when applied to a city such as Birmingham, where a figure of 100,000 such consumers could easily be reached, the personal touch would be lost, and it would be impossible to tell whether waste was going on or not. For lighting of this character he considered that the author's estimate of 45 watts per house was far too low. A fair average figure for maximum demand for ordinary class lighting was 60 per cent. of the watts installed, and with this class of lighting, where the diversity factor was very much smaller, in his opinion the maximum would considerably exceed 60 per cent. If this was so, the KW. charge might quite easily be doubled, whilst the unit charge would probably be increased, with the result that the estimated profit practically disappeared. The item of 4s. 3d. for lamp renewals seemed too low in view of the figure mentioned in the paper of 2s. 8d. per metal-filament lamp. He would like to know if Mr. Fennell had any trouble in obtaining wayleaves from the owners of houses who did not propose to use the light.

Mr. Milns (Birmingham Corporation) said that such a scheme would doubtless be pushed in a town like Wednesbury, which had a very large power supply but a comparatively small lighting load; while in other towns with a heavy lighting peak no special effort would be made to obtain this class of business. He did not think the plug switch would pass the I.E.E. Rules. Some charge should be made for lamp renewals, say 6d. per lamp, and this charge would be a check on waste of current and breakages of lamps, as the consumer would know that the life of the lamp depended upon the hours of use. The revenue of 16s. per 60-watt lamp per annum seemed very high compared with the revenue from similar houses taking current through prepayment meters, which worked out at 6s. 6d. per 60-watt lamp per annum, and about 4s. 6d. per 50-watt lamp from large houses.

Mr. Holden inquired the method employed when cutting off defaulting consumers. He was surprised to hear that current was anywhere so cheap that waste might be ignored. He considered that the expense of meters was over-estimated by Mr. Fennell. A first-class D.C. 1½-ampere meter could be obtained for not much over 30s., and an A.C. meter for less than 30s. Such a meter would certainly last ten years, and could be maintained for 5 per cent. per annum, so that 5s. or 6s. per annum was ample to cover its cost. Electrolytic meters would probably come out cheaper still. The absence of a meter confined the consumer to the use of current for lighting purposes. Although the use of current by cottagers for heating or cooking was not probable just at present, yet if the great advantage and direct saving to be effected by the use of laundry irons was properly explained to these consumers they would adopt them at once, provided they could be obtained on hire at favourable terms.

Mr. S. T. Allen considered that a great deal would be done in the future in this direction due to decreased costs, more extensive hiring powers, and also because the health departments of the different local authorities would more and more realise that electricity supply for workmen's dwellings was as important to the welfare of the occupiers as good sanitation and pure food. Mr. Sillar, of Colchester, about eight years ago read a paper before the Municipal Electrical Association, in which he said the supply was metered in each house; prepayment meters were used, and taking 82 consumers, the average number of lamps per house was 5, the average revenue was 10½d., per week, and the average profit obtained was 8s. 2d. per consumer. With the five lamps the average number of units per annum was 100. This seemed to show that Mr. Fennell's estimate of 100 units per annum for 3-lamp installations was a liberal one. He did not consider that a wall plug with a flexible attachment should, for such houses, constitute a main switch, especially considering the class of children and possible trouble due to them. He would strongly recommend an ironclad switch, which would not add much to the expense of the installation. Switch lampholders were not suitable at all for such houses. If the system was to be universally adopted, provision should be made in the scheme for any number of lamps. The time to write off the entire cost of the wiring could well be extended to eight years. He disagreed with Mr. Fennell's scheme in that it did not make any provision in the main services or subservices for cooking, heating, or other loads. There were enormous possibilities in the future in this direction, especially when the cost of electricity supply was still further reduced and when electric cookers, heaters, etc., could be hired out at the same price as gas apparatus.

Mr. F. W. Foster thought the final success of any scheme as outlined by Mr. Fennell would depend largely on the development of the ½-watt lamp. The cottages' maximum demand could not coincide with any other station demand. The variable charge for different seasons was a valuable feature, and the "insurance collector" idea was new. The balance-sheet was incomplete.

Mr. W. Fennell, in reply, said it was gratifying to find an almost unanimous opinion in favour of extending the benefits of electricity to the artisan; the chief object of his paper was, therefore, served. Mr. Chattock's objection on the ground that Birmingham was too big would disappear if the semi-criminal quarters were avoided. Mere size was no disadvantage; it cost less per consumer to supervise 10,000 than 300, and the profit was shown as so much per consumer. The results of check meters for blocks of buildings were not yet available, but the whole point of the system was that with the low unit costs (.35d.) there would still be a handsome profit if the units used were double the already liberal allowance. His observed figure of 108 lamps per 100 houses must be adhered to as the peak maximum demand on which the standing charges must be reckoned. The consumer's maximum demand was another matter. At times all the lamps would be required, say on Sunday evening and Bank Holidays, which were the "at home" times. This habit of Sunday and holiday visiting helped to fill up the load on the power station on the days of least demand. There had been no serious difficulties in getting wayleaves for the looped services; the tenants wanted the light, and it was in the interests of landlords in general to let them have it, because it reduced the cost of whitewashing and papering. In the only case remembered where a landlord objected, most of the tenants threatened to leave. When a consumer wanted a supply for heating he could have it as a separate matter through a "cheap" meter. Why go to the expense of putting in 300 meters because 30

consumers might want a flat-iron or grill? The slot meter had failed in most places because it did not fit in with human nature. It gave the consumer an exaggerated idea of cost—the money found in the meter never amounted to anything like the amount the consumer imagined had been supplied. It produced less revenue, only 6s. 6d. per lamp against 10s. with the rental system. The success of the rental system was due to the certainty of the charges; the housewife knew exactly how much money to leave out for the collector. There were no extras: nothing to pay for wiring, lamps, and repairs. Several speakers thought the wall-plug switch dangerous to children; he omitted to state in the paper that it was fixed five or six feet from the ground. A 5-amp. plug was not unsuitable for breaking half an ampere. The twin flex surface system was mechanical enough for these houses. In many cases the premises were not very clean and several applications had been refused for this reason. The lead-covered twin system was the most suitable. The risk of consumers using the bedroom lamp as a night light was the one practical difficulty which had arisen. It was forbidden in Wednesbury under penalty of removing the bedroom light, with good results, as the threat of disconnection raised visions of a return to the bad old days of candles or cheap oil lamps. A pearswitch at the bed should be provided. They had purposely avoided collection by the landlord, and often got paid in preference to the landlord. It was usual to owe the landlord for several weeks' rent, and there would be a risk of the landlord claiming payments on account as being for his rent and not for the electricity.

CURRENT-LIMITING REACTANCES ON LARGE POWER SYSTEMS.

By K. M. Faye-Hansen, A.M.I.E.E., and J. S. Peck, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *March 26th*, 1914.)

The general effect produced by a series-reactance is a drop in voltage in the circuit, provided the power factor is unity or lagging; and the greater the lag the greater is the drop in voltage. The power factor is also decreased on account of the reactive kilvolt-amperes of the choke coil. Thus it is evident that the introduction of reactance affects the regulation and power factor of the system; and these are two of the factors which determine the sizes that should be placed in generator leads or feeders.

1. Reactance in Generator Leads.

In normal operation the reactances will produce a drop in voltage between the generators and the busbars; but this can readily be compensated for by varying the excitation of the generator.

In the event of a short-circuit upon a feeder, the busbar voltage will drop to zero (provided the impedance of the fault and of the feeder between the fault and the busbars is negligible), and all generators and other synchronous apparatus on the system will feed into the short-circuit. If the system is a very large one, this current may be enormous and may damage or destroy the circuit-breaker in the defective feeder. It may also cause serious damage at the fault. The generators should not suffer, because the output of each is limited by the reactance in series with it; and for the same reason the generator circuit-breakers should not be damaged. The worst feature of this arrangement is that the whole of the busbar being affected, all synchronous apparatus throughout the system may fall out of step and a complete shut-down is likely to occur, as the circuit-breaker requires an appreciable time to operate even when set for instantaneous tripping. However, if the fault occurs at any considerable distance from the generating station, the impedance of the feeder will greatly reduce the current, so that the busbar voltage will drop comparatively little and synchronous apparatus will not fall out of step.

In the event of a short-circuit on a generator, the current which can flow from the busbars to the defective generator will be limited by the reactance, and the circuit-breaker should be able to disconnect the generator from the busbars without difficulty. Also the voltage of the busbars will not fall to zero, and the operation of synchronous apparatus will probably not be affected; it will be evident that reactances in generator leads alone are of little value except for protecting generator windings and circuit-breakers, as they offer no guarantee of continuity of service except in the case of the breakdown of a generator. Assuming that the average generator has a reactance of 6 per cent., and 6 per cent. is added in an external coil, the maximum current that can flow equals 8⅓ times the normal current, or somewhat more. Any generator should be able to stand a current rush of this magnitude. Where a step-up transformer is connected between the generators and busbars, it may be designed with high internal reactance, thus giving the effect of a reactance coil without any appreciable additional cost.

2. Reactance in Feeders.

Each feeder having a reactance coil in series with it, if some feeders are more heavily loaded than others, the voltage drop on the feeders will vary and cannot be compensated for by varying the busbar voltage.

In the event of a short-circuit upon a feeder, the current supplied to the fault will be limited by the reactance and the busbar voltage will be affected to only a small extent. The circuit-breaker should be able to cut out the feeder without difficulty, and only the one feeder will be affected. The generators will not be heavily overloaded, and none of their circuit-breakers should open.

A short-circuit on the busbars will short-circuit all the generators, and if the windings are not properly braced may cause serious damage. Also the whole system will be thrown out of action and each generator circuit-breaker must open the short-circuit current of one generator.

Should a short-circuit occur between the generator and the circuit-breaker, all the generators would feed into the short-circuit, and the circuit-breaker on the defective generator would have to open the short-circuit current of all the other generators. In this case the voltage of the busbars will drop to zero and all synchronous apparatus may fall out of step, and a complete shut-down is likely to occur.

If the generator windings are braced to withstand short-circuits, this arrangement of reactances possesses marked advantages over that of placing them in the generator leads, for the great majority of faults occur on the feeders or on apparatus connected directly to them; and with feeder reactances such faults can do no serious damage to the system. Furthermore, busbars and connecting cables can be so thoroughly insulated that a short-circuit on them is a somewhat remote possibility.

If the rating of a feeder is one-quarter that of a generator, a reactance of 3 per cent in the feeder will pass no more current than will a total reactance of 12 per cent. in the generator, while if there are several generators in parallel, the effect of the feeder reactances is proportionally increased. Thus unless the total feeder rating is very greatly in excess of that of the generators, the total k.v.a. capacity of the feeder reactances may be less than the k.v.a. capacity of the generator reactances, though the number will in general be much larger.

Where step-up transformers form part of the feeders the transformers may be designed with high internal reactance without appreciable increase in cost.

3. Reactances in Busbars.

The only purpose in installing busbar reactances is to limit the amount of current that can flow into a fault on one section of the busbars, and so to confine the disturbance to that part of the system on which the fault occurs. Reactances are chosen of such a value as to permit parallel operation during normal conditions, even with a considerable exchange of energy between the sections; while in the event of a short-circuit occurring on any section, the current rush is limited to such a value as not seriously to interfere with the operation of other sections.

Having decided upon the maximum allowable displacement for parallel operation and the maximum difference in load which is likely to occur between the different sections, the value of the reactance may be determined immediately.

In a very large station the busbars would probably be separated into several groups of from 20,000 to 40,000 kw. capacity each. In a case of this kind the amount of energy that it may be necessary to transfer between sections is assumed and the reactances made large enough to limit the current to a reasonable value in case of a short-circuit, but not too large for satisfactory parallel operation. A size that will give 50 per cent. of normal voltage with the full-load current of one busbar section is usually a reasonable value to choose.

The use of busbar reactances is carried to the extreme when the busbar is divided by them into as many sections as there are generators. Arrangements will always be made for short-circuiting any reactance so that in the event of a generator being shut down the feeders connected to its busbar section may be supplied directly from one of the adjacent generators. Arrangements must also be made for opening the busbar between any two generators in order to isolate any section of the busbars that might develop a fault.

The advantages of busbar reactances are that:—

- Trouble is confined to the particular section on which the fault occurs.
- The amount of current that can be fed into a fault is reduced.
- The danger in the case of bad synchronising is considerably reduced.

The disadvantages are that:—

- No protection to a generator is given when a short-circuit occurs on or near its busbar section.
- The generators coupled to the different busbar sections must be operated with a certain angular displacement in their voltages.

It will be clear that reactances between bus-bar sections may be exceedingly useful for confining any disturbance on the system to that particular section on which the trouble occurs, and thus it is possible to operate a large number of generators

or two or more stations in parallel with almost the same factor of safety against a complete shut-down as though they were operated separately. It is seldom, however, that busbar reactances are used except in conjunction with reactances in generators or feeders, and it is proposed now to discuss very briefly their combined use.

Reactances in Generators and Busbars.

Since the principal object of the generator reactances is to protect the generator windings, these will naturally be chosen with reference to the characteristics of the generators, and evidently one will be placed in each generator lead. The more completely the busbars are divided up by reactances, the smaller will be the portion of the system affected, and from this point of view reactance is desirable between each generator and the next; but as this may involve some slight complications in the normal operation of the plant, it may be considered desirable to operate with several generators connected to the same busbar section. The size of the reactances will be determined by the amount of energy that must be transferred from one section to another, and by considerations of successful parallel running.

The advantage of this combination over the use of reactances in generators alone is very great, as it confines the trouble to the particular busbar section affected; it reduces the load on the feeder circuit-breaker, and reduces the damage at the fault. Perfectly satisfactory operation should be obtained with this arrangement.

Reactances in Feeders and Busbars.

This arrangement probably gives the greatest possible freedom from serious operating troubles, for the feeder reactances protect from all troubles outside the station, while the busbar reactances confine any internal trouble to the busbar section on which it occurs.

The objections are that it affords no protection to the generators in case of a short-circuit on the bus-bars, that it requires a large number of reactance coils unless group feeding is adopted, and that it affects the regulation of the feeders, though this will ordinarily be of minor importance. If the generators can safely withstand a short-circuit, or if the chance of a short-circuit on the busbars is considered negligible, some form of this arrangement probably offers the most complete solution of the problem.

When it is attempted to apply this knowledge to a concrete case there are so many factors to be considered that the determination of the best possible combination becomes a difficult problem. For example, if the busbars are divided into sections by reactance coils, and the different sections feed into the same busbars at one or more sub-stations, the impedance of the cables connecting the different sections may be far less than that of the reactance coils, so that much of the advantage gained by using the reactance coils is lost. Also there is the possibility that when one section is more heavily loaded than another, the cables on one section will be overloaded, due to the angular displacement in voltage between the sections. Thus it is desirable when using bus-bar reactances to feed one sub-station from one section of the busbars, rather than from several sections, or, failing this, to use fairly large feeder reactances. When the feeders are very long this may not be of importance. When suitable feeder arrangements can be made, there seems no doubt as to the great desirability of using busbar reactances in large stations as an insurance against a complete shut-down.

In the case of feeder reactances, the greatest flexibility is obtained by placing reactances in each feeder; this is quite feasible where the feeders are of large size and comparatively few in number, but where there are many feeders of small size the number of reactance coils becomes excessive and group feeding must be adopted.

Reactances in generator leads present the simplest problem, once it has been decided to instal them. The only difficulty is to determine whether they are necessary in addition to the busbar reactances. The following points should be considered:—

If the generators will stand a short-circuit, reactances serve very little purpose except to protect the system in case of a generator breakdown and to reduce to a small extent the current that flows into a short-circuit. Busbars may be so thoroughly insulated as to reduce the possibility of a short-circuit to almost a negligible amount. It is now becoming fairly common practice to use single-core cable between the generators and busbars. These cables can be so arranged that an "earth" is almost certain to occur before a short-circuit, and a suitable discriminating device will cut off the generator and open its field circuit the instant that an "earth" occurs. Thus the chances of a short-circuit on the generator terminals may be greatly reduced. But there is still the possibility of a mis-phase where more than one generator is connected to the same busbar section; and if the generator will not withstand such an accident it will be advisable to use reactances in its leads.

In order to show a typical lay-out for a large station, the following conditions have been assumed:—

Total generator capacity, 100,000 kw.
Seven generators (4 of 10,000 and 3 of 20,000 kw.
Feeders of 2,000 and 5,000 kw., the 2,000 kw. feeders being arranged in groups of 10,000 kw. each.

A diagram of connections is shown in Fig 1. In this case, the busbars are divided into five sections of 20,000 kw. each. Each section of the busbar is fed either by one large generator or by two small ones. Between each busbar section is connected a reactance coil, which, with the full-load current of one busbar section, will give a voltage across it equal to 50 per cent. of the normal.

Each reactance coil is arranged so that it may be short-circuited by means of an oil circuit-breaker, and an oil circuit-breaker is also placed between sections of the busbars.

A ring busbar system is adopted, which increases considerably the flexibility of the arrangement.

Each group of feeders will have in series with it a reactance coil, which should be of such a size that with the group fully loaded there will be a voltage across it of approximately 5 per cent. Each 5,000-kw. feeder should have in series with it a reactance coil, which will have a full-load voltage across it of

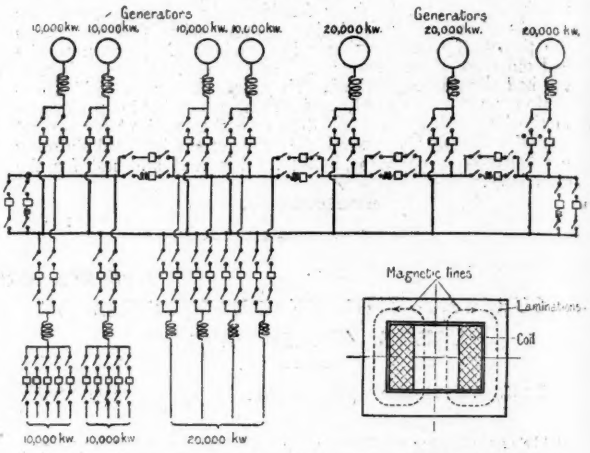


Fig. 1.—Station Lay-out with Reactances.

Fig. 2.—Section of Choke Coil.

approximately 2½ per cent. In series with each generator there should be a reactance of approximately 5 per cent.

It is preferable to have each sub-station fed from one section of the busbars in order that circulating currents may not flow through the cables from one busbar section to another. The ring-main busbars and double set of feeder switches permit any sub-station to be switched over to another section in case of necessity.

Discriminating devices should be provided so that in the event of an "earth" on any feeder it will be cut out. Also each generator should be arranged in a similar manner, so that it will be cut out in the case of an "earth" or other fault developing on it.

The Design of Current-limiting Reactances.

Current-limiting reactance coils have heretofore been designed almost exclusively without iron in the magnetic circuit, upon the assumption that it would not be possible to use an iron circuit and obtain a straight line relation between the voltage and current without increasing the size, price, and losses in the coils. While this may be true for feeder reactances where the maximum short-circuit current is perhaps 20 to 30 times the normal current that the coils must carry without overheating, it is not true in the case of busbar reactances where the maximum current will as a rule not be more than 4 to 10 times the normal current, and under certain circumstances the coil with a partial magnetic circuit will prove more economical than the air core even for generator reactances.

The larger the capacity of a reactance coil and the lower the frequency, the less will be the advantage obtained by using iron in the magnetic circuit.

Fig. 2 shows diagramatically the construction of a choke coil having a partial iron circuit. It will be noted that inside the coil there is no iron, and therefore the air-gap is very large, while the coils are enclosed by a complete iron circuit. This construction has the following advantages compared with air choke-coils:—

1. Under normal working conditions there is no external field, so that the whole coil may be placed in a metal tank without fear of eddy currents, as though it were a transformer.
2. The coil may be operated in oil, thus avoiding the necessity for forced cooling, though the air-blast type can be used if preferred.
3. Less room in the station will be required, as it is possible to place the apparatus in the same position as a transformer and to handle it just as though it were a transformer.
4. The metal containing case may be earthed so that there can be no danger from accidental contact with the coil.

5. It is not essential to use a laminated cable winding, as the direction of the flux is such that a solid winding may be arranged by careful designing to avoid any serious loss.
6. The construction being practically the same as that of a transformer, standard transformer parts may be used to a very great extent, thus reducing development costs and the time required for manufacturing.

Discussion.

Mr. W. B. Woodhouse, who opened the discussion, referred to the general tendency of looking on all protective devices with suspicion. Reactance was to be introduced for protecting apparatus and limiting disturbances, but practically all apparatus in an A.C. system, except the switchgear, possessed reactance and if the apparatus could be constructed to withstand short-circuit currents, as it could, additional protection was unnecessary. The author has assumed 6 per cent. reactance for the average generator, but nowadays this should be 10 or 15 per cent; he thought the reduction of momentary currents was not beyond the powers of the generator and transformer designer. Feeder protection was rather a question of switchgear and he reminded them that Mr. Leonard Andrews had described a protective system using reactances some years ago. The amount of power to be absorbed by the switch in opening the circuit depended on the reactance of the circuit as a whole, and it was possible that the switchgear was good enough. He thought it preferable to put sectional reactances in the bus-bars. The cost of introducing reactances was not perhaps great, but the cost of running, and providing apparatus to keep up the necessary pressure regulation might be considerable; it should be regarded as question of insurance. He asked what was the limit of reactance that could be introduced between generators and still preserve satisfactory service. Although high-speed machinery had brought some disadvantages, there were great compensating advantages in its use.

Mr. G. W. Partridge said he thought his company was the first to make practical use of reactances in this country, having had them at work for 3 years, with satisfactory results. In their case the turbine plant supplied the Brighton Railway single-phase line, and the trains were connected direct to the station bus-bars, there being no intervening sub-stations. The reactance coils were designed to withstand momentary short-circuits of 20,000 amperes and weighed some 13 to 15 tons. He, with the assistance of the President (Mr. Duddell) had recently carried out some oscillograph tests on the behaviour of switches with and without reactances in series, on the occurrence of a short circuit. The turbines were of 7,500 kw. with high internal reactance. With reactance in series the switch had no difficulty in breaking the circuit; four or five times full load current was flowing, and the time taken was about $\frac{1}{4}$th sec. Without reactance the switch arced badly and a considerable amount of oil was thrown out; this was a trouble which, he maintained, would be obviated by using either internal or external reactance. Describing the effect of a short-circuit on the exciter current of the generator, with no reactance, he pointed out that the field voltage was reversed and that the current increased enormously and took the form of an alternating current. He thought reactance in this case would have damped out the disturbances. On short-circuiting two phases of a generator he found no pressure rise in the third one which had been disconnected.

Mr. J. Shepherd (L.C.C.) said he estimated the approximate cost of reactances at 10 per cent. that of the generators, and the total expense of installing them at 12 to 15 per cent. that of the generators. He thought some form of relay was more suitable for feeder protection, as there was usually enough time with a short-circuit for a relay to act. Either internal or external reactance was necessary for a generator and if the bus-bar system was extensive there were always risks which might be lessened by inserting reactances. He thought, however, that it would be difficult to house them, without a special building, in most cases. He asked what had become of the large induction generators mentioned by Steinmetz a few years ago.

Mr. A. R. Everest said generator windings must be protected, and though it was easy to provide sufficient internal reactance for a 50-cycle machine, it was not always possible with a 25-cycle generator to limit the current to ten times full load value. With feeder reactances there would be a voltage drop, and to use a large number of reactances would be prohibitive as to space and cost, but the grouped feeder and reactance arrangement could be used. Bus-bar reactance also limited the current at a feeder fault as well as protected the generator. He believed that the air-core reactance was a safer construction than many others.

Mr. Hollis (whose recent paper on this subject will be found on page 465) pointed out that the use of reactance increased the rating of the switchgear. The objection of bad regulation, with reactance in long feeders, could be got over by the use of synchronous machinery. Internal reactance on a generator did not protect the machine itself when it broke down, but external reactance would do so.

Mr. E. W. Wedmore pointed out that reactances in parallel had little influence on the power factor of the system, and he preferred them to reactances in series. He agreed as to the necessity of reactance in the generator circuits, but it would be impracticable to protect the switchgear of a 100,000-kw. station in this manner. This could, however, be effected by the use of bus-section reactances, which would have a limiting effect on the short-circuit current on every switch in the system. Probably large stations would have step-up transformers in the feeder circuits, and their inherent reactance would assist in limiting short-circuit current outside the station. The protection afforded by sectioning the bus-bars could be increased by reducing the size of the section or increasing the ohmic value of the reactances. The author's suggested ohmic value giving a 50 per cent. drop, appeared much too high; it would reduce the short-circuit current to about 13 times the output of the section, which nearly approached the result obtained with an infinite reactance. The first 5 per cent. reactance was much the most effective. He found that an ohmic value of 20 or 25 per cent. gave a more satisfactory commercial solution in this case. Rather than employ 50 per cent. ohmic value it would be better to limit the size of the section; the furnishing of magnetising current for such a reactance would seriously limit the output of a machine, which was being assisted from adjoining sections. The size of section was limited by the number of machines, and it was important that the size of section should be kept down in the interests of consumers' apparatus in case of short-circuit currents. A mile of .1 square inch cable had a useful effect in limiting short-circuit current to the individual consumer if there were not other parallel feeders, and this feature was utilised for protecting distribution switchgear, the trunk cables leaving the station being sub-divided into smaller sections leading to distribution boards and the consumer's switch being supported by several switches in series before the station was reached. An alternative arrangement for protecting an individual feeder was to use two switches in series, one of which cut in reactance and the other opened the circuit. He concluded by urging that as bus-bar reactance was really a long extension of the bus-bars, it should be treated with great respect.

In replying, Mr. Faye-Hansen pointed out that Fig. 1 showed reactances used in every possible position, but it was not suggested that this was necessary, especially as regarded generator reactances, if the machines were suitably designed.

TESTS ON A KAPP VIBRATOR.

Last year Dr. Gisbert Kapp read a paper before the Institution of Electrical Engineers (abstracted in our issue of May 9th,

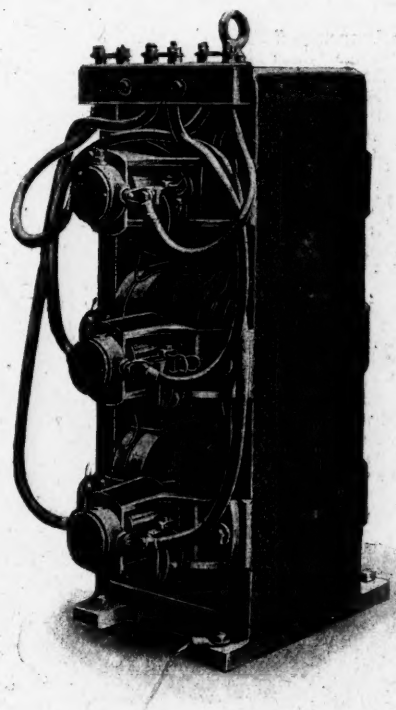


Fig. 1.—Kapp Vibrator.

1913), in which he described a new form of phase advancer invented by him and called the "Kapp Vibrator." Messrs. Sandycroft, Ltd., obtained a licence for the manufacture of

these vibrators, and after devoting a considerable amount of time to their study, recently received an order for, and successfully completed the manufacture of, their first vibrator (other than a purely experimental machine). This vibrator has since been put into regular commercial service and, being the first of its kind, has excited great interest.

The vibrator is working in conjunction with a 330-B.H.P. induction motor built by Messrs. Siemens Brothers Dynamo Works, Ltd., and is installed at the Chemical Works, Late H. and E. Albert, South Bank, Near Middlesbrough. The motor is a 12-pole machine operated from the system of Cleveland and Durham Electric Power, Ltd., who supply energy at a pressure of 2,750 volts and a frequency of 40 cycles per second.

The vibrator is a phase advancer, or exciter, for use with induction motors or generators respectively, and consists of a magnet frame carrying three sets of 2-pole field-magnets, in which revolve three armatures of the usual direct current type. The three armatures are connected in mesh to the slip-rings of the induction motor as shown in the accompanying diagram, fig. 2, which also shows all the necessary connections (although in some cases it may be desirable to provide an inter-locking arrangement to prevent the motor from being started with the vibrator in circuit, that is to say, practically on short-circuit).

The field-windings are excited with direct current. The low-frequency rotor currents in the armatures cause the latter to rotate first in one direction and then in the opposite direc-

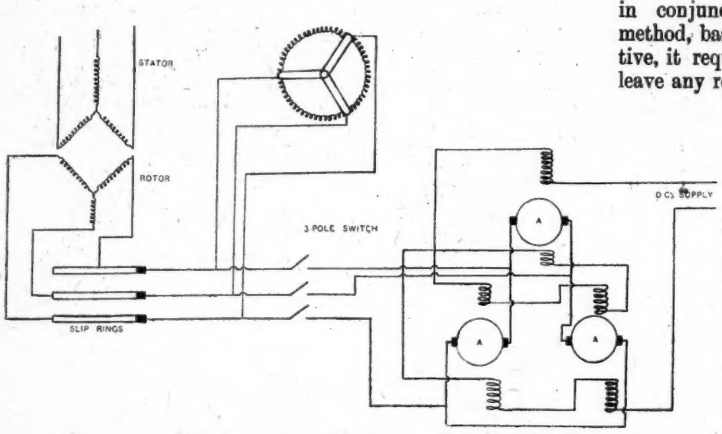


Fig. 2.—Diagram of Connections of Kapp Vibrator.
After closing the three-pole switch, the starter is placed in the "off" position.

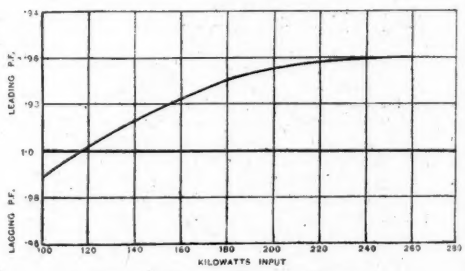


Fig. 3.—Power-Factor Curve.

tion with the frequency of slip. This rotation induces in each armature a voltage which is opposed to the E.M.F. of self-induction of the motor, and is greater than the latter by an amount sufficient to supply through the resistance of the rotor windings the necessary current to produce the magnetic field of the motor. With normal excitation of the vibrator no magnetising current flows in the stator windings, and consequently the motor operates with a power factor of unity. If the exciting current be increased, the greater voltage then induced by the rotation of the armatures will produce in the rotor windings a magnetising current greater than that necessary to produce the magnetic field of the motor, and consequently a leading current will result in the stator windings.

Fig. 1 shows the vibrator under description, which it will be noticed, is a small and compact machine. The armatures are only 10 cm. in diameter, and at full load with a slip of 2.45 per cent. rotate about 3½ revs. in each direction. Since the frequency of supply is 40 cycles per second they change their direction of rotation every half second.

The results of the tests made are plotted in the accompanying curve, which shows that at half load the power factor was 0.99 leading and at full load 0.96 leading. The corresponding power factors without the vibrator were 0.76 lagging and 0.87 lagging respectively. The machine was guaranteed to give unity power factor from half load to full load, and when the field current was adjusted for the latter value the excitation loss in the fields of the vibrator was only 50 watts.

The vibrator will work equally well with an induction machine running either as a motor or a generator without change of connections, so that when used with machines driving winding engines or locomotives complete conpensation would be obtained under all conditions. A valuable feature of the vibrator is that in the event of any mishap (such as, for instance, the failure of the field) it may be left in circuit even although failing to fulfil its function as a phase advancer, without affecting the running of the motor with which it is installed.

The use of the vibrator improves the operating qualities of a motor not only by correcting the power factor, but also by considerably increasing its overload capacity and maximum torque. Under favourable conditions the efficiency of the motor will be improved. The overload capacity will be increased because not only the stator currents, but also the rotor currents, of the motor will be reduced when the motor is operating above the load corresponding to its maximum power factor.

The vibrator described above was installed to the order of Cleveland and Durham Electric Power, Ltd., and was built at the works of Messrs. Sandycroft, Ltd., near Chester. By the courtesy of the Chemical Works, Late H. & E. Albert, it was inspected on March 20th last by Dr. Kapp and a large number of engineers connected with the Newcastle and Tees-side Local Sections of the Institution of Electrical Engineers.

RADIO-TELEGRAPHIC RECORDER.

By Dr. ALFRED GRADENWITZ.

The receiving process used in connection with early experiments in wireless telegraphy called for the use of a Morse recorder. Recent processes utilise several kinds of detector in conjunction with a telephone receiver. While this method, based on acoustic principles, is much more sensitive, it requires remarkable skill, and, moreover, does not leave any record. Endeavours have therefore been made repeatedly to combine this method with the use of a graphic recorder, but the apparatus so far suggested in this connection have been too delicate to lend themselves to anything like a general use.

At a recent meeting (January 12th, 1914) of the French Academy of Sciences, Prof. Bigourdan demonstrated a recording apparatus devised by M. Tauleigne, in conjunction with the well-known manufacturers, F. Ducretet and E

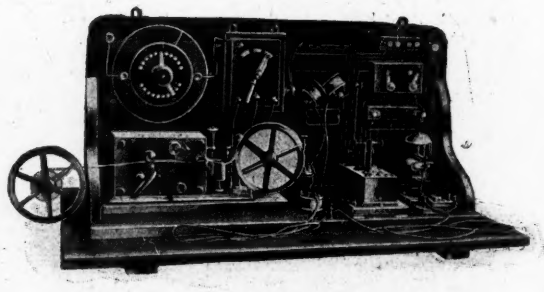


Fig. 1.—Complete Receiver.

Roger, which affords the advantages of being simple in construction, robust, and easy to regulate and operate. It allows all signals of sufficient intensity for acoustic reception at 20 cm. from the telephone receiver to be readily recorded.

The apparatus is protected by letters patent, and comprises the three following parts :—

1. A special electrolytic detector allowing the depth of immersion of a platinum wire electrode to be regulated.

2. A polarised magnetic relay.
3. A variable-speed Morse recorder.

These parts are supplemented by a tuning coil and various accessories.

The positive electrode of the detector E (figs. 1 and 3) is constituted by a platinum wire, dipping into the liquid to a depth regulated by means of the upper button B (fig. 1). The negative electrode is constituted by a carbon. This arrangement allows a battery P_1 of two Leclanché cells to be used as source of current, the electrolyte being a mixture of 10 parts of pure sulphuric acid with 90 parts of water.

Fig. 2 is an outside view of the relay, and allows all regulating organs to be seen. The movable lever J carries a light contact spring designed to be bent on turning the screw K; the lever swings freely between the two stop

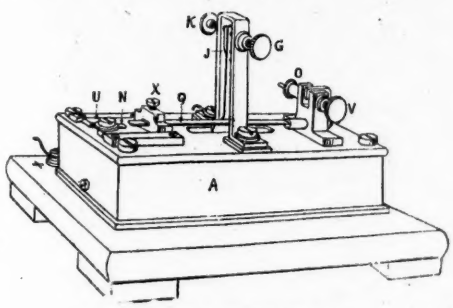


Fig. 2.—Polarised Relay.

screws G (insulating contact) and K (platinum contact), on its being removed ever so little out of its position of equilibrium. It will, on the other hand, strike one screw or the other, when this is at the end of its path. Should this for some reason or other be impossible, the effective length of the antagonistic spring Q will have to be altered.

This relay is inserted into the circuit of the detector E, so that the positive pole of the battery P_1 is connected up to the positive terminal of the relay A.

Under the action of the current, the lever J will leave the insulating contact of the screw G, on which it only presses very lightly in the state of rest, and will make contact with the screw K. The length of stroke is controlled by the two screws G and K, and the position of

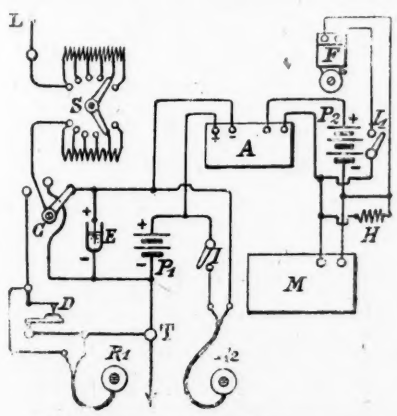


Fig. 3.—Diagram of Connections.

equilibrium corresponding to the maximum sensitiveness is obtained by turning the head of the screw V. This screw acts on a lever arm twisting the spring Q; a spring situated in the socket O returns the lever to its former position, on turning the screw in an opposite direction. The telephone receiver R_1 has been provided, to guard against too intense an action on the detector.

The Morse recorder has been specially designed with a view to allowing the rate of unwinding of the paper tape to be regulated in accordance with the rate of transmission of wireless signals. The most suitable arrangement consists of connecting the apparatus up in series, the self-induction coil S and the detector E being inserted in the circuit constituted by the antenna and the earth-plate.

This recorder has been used in receiving the Eiffel Tower signals up to a distance of 400-500 kw., with antennæ of moderate dimensions. M. Tauleigne has, however, designed an apparatus which, when connected up to the antenna and the receiver, allows Morse records to be taken at practically any distance from the transmitting station.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Mercury Vapour Lamps.

With reference to the correspondence appearing in your columns under the heading "The Lighting of the I.E.E. Lecture Theatre," we feel that we cannot allow Mr. Frank Broadbent's letter, appearing in the current issue, to pass without comment.

Mr. Broadbent makes some remarks regarding the partially decorative application of mercury vapour lamps in the I.E.E. theatre, and we feel that your correspondent wrote more in relation to this particular installation than to mercury vapour lamps in general. The remarks are very apt to be taken as applying generally, and are entirely misleading. We should be very glad to meet Mr. Broadbent and to demonstrate to him that mercury vapour lamps are a strong commercial proposition, and have very many undoubted applications. While we are glad to acknowledge the influence of the Electrical Review, we must claim that some, at least, of the success of the mercury vapour proposition is due to the merit of the system.

The Westinghouse Cooper Hewitt Co., Ltd.
Mark Foulds, *Manager.*

London, N., *March 31st*, 1914.

Creosoting Wooden Poles.

I should be glad if any reader would give me an idea of a simple apparatus for creosoting poles carrying electric wires, to preserve them from dry or wet rot in the tropics.

The poles vary in length from 25 to 70 ft. Cast-iron piping is available in any size or length for a bath. Superheated steam and electricity are also at hand. As creosote is expensive here, would coal tar serve? Is there any chemical that I could use in the bath that would disagree with the stomach of white ants? Solignum is available but expensive in large quantities. Iron poles are also too costly, but concrete poles seem a good idea. Could any reader refer me to any literature on the latter subject?

Any hints will oblige.

Ta Tao.

China.

[The following articles, &c., on the preservation of poles have appeared in our pages in recent years:—January 13th, 1911, p. 79; September 8th, 1911, p. 386; December 22nd, 1911, p. 1012; February 2nd, 1912, p. 193; February 9th, 1912, p. 203; June 28th, 1912, p. 1059; August 30th, 1912, p. 335; November 1st, 1912, p. 709; August 22nd, 1913, pp. 306 and 320; September 19th, 1913, p. 444; January 16th, 1914, p. 85.—Eds. Elec. Rev.]

A New Aluminium Alloy.—A new alloy of exceptional lightness, considerable mechanical strength, and freedom from electrolytic action, is stated to be gaining popularity in British engineering circles. It is named "Ivanium." This alloy, obviously one of aluminium with one or more metals occupying positions, relatively near aluminium in their electrochemical properties, is only 2½ per cent. heavier than pure aluminium. It is stated to have the property of retaining its hardness after being subjected to heat, and of being non-magnetic. When polished, the surface remains bright indefinitely. Castings made in ivanium are stated to be equal in finish to the finest gun-metal. The alloy does not clog a file, and it can be screwed, tapped, milled, and soldered with ease. Joints soldered together are stated to be as strong as the original metal. The melting point is low, about 300° C., and the alloy is claimed to be a useful deoxident.—*Standard.*

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

E.A.C. Heavy Duty Inching Starter.

We recently inspected a new patent starter which has been developed by the Electrical Apparatus Co., Ltd., of Vauxhall Works, South Lambeth Road, S.W.; in this device the usual no-volt coil and spring return have been eliminated, their functions being performed by other means. This change enables the angular movement of the starting lever—and, therefore, the number of contacts employed—and the pressure on the contact brush or shoe to be increased. It is impossible to start the motor without first inserting all the resistance, and it is impossible to leave any of the resistance in circuit when the motor is running.

From the drawing, fig. 2, it will be seen that there is á frame or cradle pivoted on the starting lever, and held to the left by a spring.

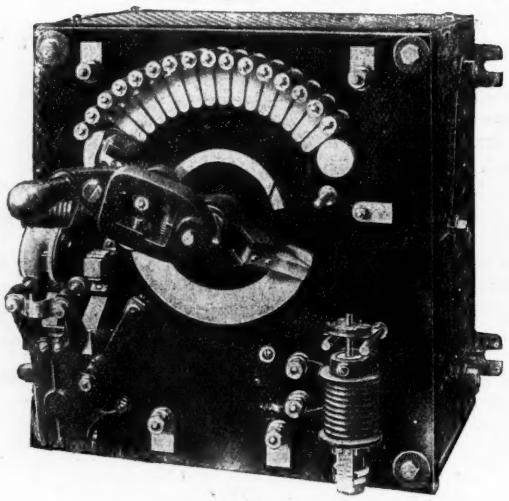


Fig. 1.—A New E.A.C. Starter.

On pushing the handle to the right a contact is made at G, but this is ineffective unless the lever is standing over the contact A, that is, in the starting position. This condition being fulfilled, the first motion of the handle closes the circuit of the solenoids which actuate the circuit breakers D D, causing these to close, simultaneously inserting resistances into their circuits by opening contacts at F F through the action of the fingers E E. Thus the

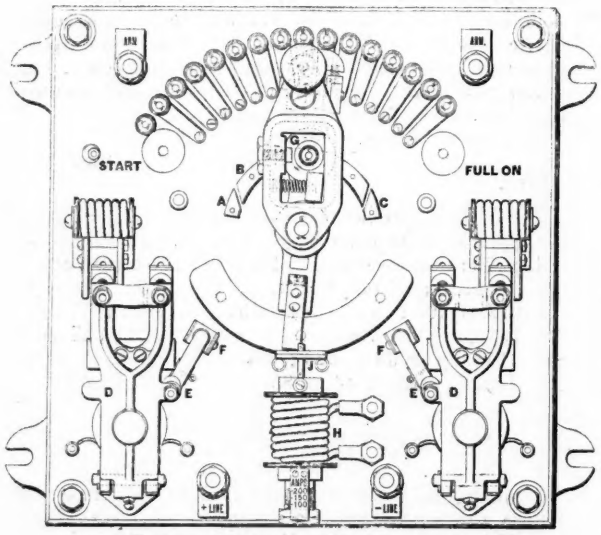


Fig. 2.—Connections, E.A.C. Starter.

current in the solenoids is reduced to a small value sufficient only to keep the breakers closed. The starting lever can now be moved to the right, cutting out the resistance by steps; but if the pressure on the handle is relaxed for an instant, the contact G is broken and the circuit-breakers immediately open. If, on the other hand, the resistance is cut out too rapidly, the excessive current actuates the overload release H, interrupting the solenoid current at J and opening the circuit-breakers; so long as the contact brush attached to G is over the sector B, and the handle is pushed to the right, the circuit-breakers are held in but cannot be pulled in. On arriving at the full-on position, however, with all the resistance cut out, G is over C, and in this position the opening or closing of G no longer affects the circuit-breakers, which are held in independently of the circuit through G.

The circuit-breakers when closed are at *all* times controlled by the overload release H, and it is claimed that the device is "fool-proof," for it is impossible to make a mistake with it. The circuit is never broken on the resistance contacts, but only by the circuit-breakers, which have renewable carbon breaks and a magnetic blow-out; the carbon sparking rollers shown on each segment therefore have practically nothing to do. It will be observed that as the slightest movement of the loose handle to the left releases the circuit-breakers, it is impossible to move the starter arm backwards with current on. For driving printing machines, therefore, the starter is particularly suitable, as the severe trials of "inching" are felt only by the circuit-breakers. The starter is of substantial construction and good workmanship and appears to fulfil every requirement of a good starter very efficiently. Fig. 1 shows the device as made up with one circuit-breaker.

Thermal Auto-Starter for D.C. and A.C. Motors.

The desiderata of a self-acting motor starter are that it should act satisfactorily whatever the load on the motor started, that it should be equally suitable for use in D.C. and A.C. circuits, and that standard patterns should be easily adaptable to any size or type of motor. Innumerable solenoid-actuated auto-starters have been patented, but these are applicable only to D.C. motors. They involve the use of relays, and the complexity of their construction increases as their action is made more automatic. The expansion of a hot wire may be used to move the starting switch lever, but this involves serious waste of energy in the hot-wire shunt circuit, and a constant rate of starting independent of the motor current. That form of starter which utilises the sudden increase in electric resistance of iron at a certain critical temperature by employing magnified Nernst lamp ballast resistances is useful for small machines, but the apparatus is costly and easily broken. By the use of bi-metallic contact strips, the rate of starting can be made to vary with the load on the motor, and simple, strong and effective construction and reliable action can be secured. Referring to the accompanying figure, when the main switch S is closed, current flows to the motor through all the resistance sections W, in series with which are bi-metal strips Z. Due to the heating effect of the current and unequal expansion

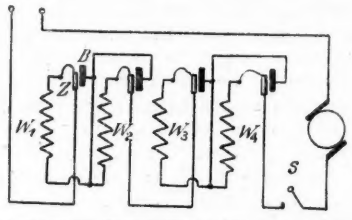


Fig. 3.—Diagram of Connections, Thermal Auto-Starter.

of its component strips, Z buckles, makes contact with B and thus short circuits the first section W_1 of the starting resistance. The remaining sections are successively short circuited in similar manner. Each compound strip is constructed so that it makes contact at an appropriate current (or all may be rated for the same current and placed at different distances from the stationary block). The steady current being rather greater than that which brings Z into contact with B, firm contact pressure is secured and contact is further improved by the addition of copper wire brushes. The area of each contact strip determines the rate of starting under given load conditions. On open circuit, the springs return rapidly to their "off" position, and there is no reasonable limit to the frequency of using the starter. Any starter can readily be converted to automatic action on this principle by adding to the existing equipment a small board carrying the necessary bimetallic strip and contact block. The springs should be protected by a cover to prevent irregular action due to varying air currents. No sparking occurs at the contacts and there are no wearing or (in the ordinary sense of the word) moving parts. Starters of this type have been built for currents up to 100 amperes, and as small power accessories, they may be worth notice and trial.—*Elek. Zeitschrift.*

[Obviously the heavier the load at starting, and therefore the starting current, the more quickly are the resistances cut out, and this is a serious drawback—Eds. Elec. Rev.]

A Highly Sensitive Thermo-Electric Pressure-Gauge.

In a paper recently presented to the French Academy of Sciences, M. Guéritot, of Nancy University, draws attention to the fact that thermo-electric junctions allow the slightest motion of air in a tube connecting two reservoirs to be ascertained, provided a small part of the air be heated beforehand. Since the air is set in motion with the slightest pressure difference between the two reservoirs, a highly sensitive pressure-gauge can be designed on this principle. The tube connecting the reservoirs is bent in the centre, and is so arranged that the knee is the highest point of the tube. The air in the interior of the tube near the knee is heated by means of a conductor traversed by an electric current, and the hot air remains at the top of the bend. The two junctions of a thermo-electric couple connected up to a galvanometer are arranged in the axis of

the tube, to the right and left respectively of the heated portion. As long as the air in the interior of the tube is at rest, the two junctions are surrounded by cold air at the same temperature, and the galvanometer records no current. As soon, however, as the air is set in motion, it carries the heated gas along one of the junctions, thus producing a thermo-electric current, which is recorded by the galvanometer. Experience has shown this gauge to give most reliable readings. The galvanometer, after each deflection, returns accurately to zero, its deflection changing direction as the gas flow is reversed. Moreover, the galvanometer readings are proportional to the volume of gas set in motion. The apparatus allows an air current corresponding to the motion of $\frac{1}{10}$ mm.^{3} to be ascertained.

The sensitiveness of the gauge can be further increased by providing several junctions, and it is possible also to obtain a graphical record by using a registering galvanometer. The inventor has made the following experiments :—

The gauge having been connected on one hand with a reservoir containing air, and, on the other hand, with a tube open to the atmosphere, it will record any variation in air pressure, through the motion of the air entering or leaving the reservoir with any such variation. The apparatus thus allows a minimal variation in pressure (as low as one-millionth of a millimetre of mercury) to be made visible.

Since the apparatus is devoid of inertia, in connection with a Pitot tube it enables sudden variations in wind velocity to be watched, and any fluctuations hidden by the variations of other apparatus to be observed.

The gauge, on account of its remarkable sensitiveness, allows in conjunction with a Riess thermometer, the energy of extremely slight electrical discharges to be measured. It, *e.g.*, gauges the energy absorbed from a Hertz resonator in the Riess thermometer.

LEGAL.

KIDDERMINSTER TRAMWAYS CASE.—CROSS CLAIM FOR DAMAGES.

(*Continued from page* 570.)

MR. ARTHUR CHARLTON, continuing, said it was brought to his notice in July last that the defendants were proposing to make the tunnel.

MR. EUSTACE HILLS : On July 7th had the Town Council refused permission to lay the cable under your tramway ?—That is so, I think.

MR. YOUNG said that he would tender evidence that they had leave.

Witness, continuing, said that it was part of his duty to inspect the tramways, and on September 2nd he received information that the defendants were commencing to tunnel under it. He went to the spot with some of his men, and notwithstanding their protest, tunneling was continued, and completed on the early morning of September 3rd.

Did it in any way affect the tramway ?—Yes. I considered that the work was improperly done.

Asked about the dimensions of the tunnel, witness said it was about 3 ft. in diameter on one side of the tramway, and 2 ft. 6 in. on the other side, tapering in the middle down to about 2 ft. It was cut through sand without any timbering or roofing. It was just a plain tunnel, cut out with shovels and short picks. The tunnel was unsafe, as the support of the tramway being taken away the concrete would not carry the heavy traffic passing over the top. When the tunnel was finished the subsoil was replaced, and an attempt was made to ram it in from the side, which was impossible. They could not ram up to the roof in that way. The tunnel was 8 ft. long. The proper way to lay a cable under a tramway was first of all to lay a pipe and then draw the cable through it. In the event of a cable breaking down when laid in that way, it could be drawn out for repairs. But in this case to get at the cable for repairs would cause a serious interference with, and a danger to, the tramway. The cable was placed in a wooden box, which was filled in with boiling bitumen. After the tunnel was constructed, it was found that a portion of the line over and near it had "dished," and it became necessary to renew the foundation and make good the faulty spot in the tramline. By the advice of the solicitor he was proceeding to cut away the cable, but when he had got three-quarters through he was stopped by the police. He had intended, had he not been stopped, to remove the cable.

MR. EUSTACE HILLS : Was that a proper step to take in making good the tramway ?

Witness : I think so

The JUDGE : I do not. The cable had nothing to do with the tunnel.

MR. HUGO YOUNG, for defendants : Our case is that the cutting of this cable was simply to prevent our using it.

During further examination of the witness as to the various items of the claim a mass of documents was put in, which drew from the Judge the comment that there seemed to be sufficient paper in the case to have filled up the tunnel.

In cross-examination, Witness said that Mr. Lycett was the managing director of the company, and was also the managing director of the Kidderminster District Electric Lighting and Traction Co., Ltd. That company supplied the electric lighting for Kidderminster. Both those companies were offshoots of the British Electric Traction Co. The Sheerness Co., with which he was now connected, was also one of the associated companies. He was aware that Messrs. Woodward were supplying themselves with electric light from one of their works.

MR. HUGO YOUNG : Do you know that the cause of all this trouble is that Messrs. Woodward had a plant for supplying themselves with electric light ?

Witness : I do not know that that was the cause of the trouble. They were generating at one of their works and wanted to connect with another so that they might have a supply for themselves.

In further cross-examination, the witness said that he, as manager of the Electric Lighting Co., wrote to the defendants protesting against their action.

MR. HUGO YOUNG : Was not the point in your mind that if you could you would stop them supplying themselves with electricity ?

Witness said that that was not the point in his mind. On July 29th an application was made for an interim injunction, and it was then represented that the cable could not be properly laid without digging down from the surface.

MR. HUGO YOUNG said that the injunction was granted in very careful terms not prohibiting the defendants from laying the cable, but ordering that they should not so lay it as to interfere with the tramways.

Cross-examination continued : A notice from the defendants was received on September 2nd stating what they were going to do. On receiving that notice, he gave his foreman instructions to take on a few extra navvies, but he did not tell him to bring a gang of roughs. As a matter of fact, 41 men were brought up, and they were supplied with refreshments, the object being to prevent the cable being laid. According to his instruction, he was going to take the cable out, and for that purpose he cut it.

His LORDSHIP : Did you want to remove the cable to prevent these people using the current between their two works ?

Witness : No. I was endeavouring to remove the cable according to orders.

His LORDSHIP : Do you suggest that the cable could do any harm to the tramways ?

Witness : Not for the time being ; but it might do so in the event of anything happening to the cable in the future.

By MR. YOUNG : An injunction was obtained to prevent the Tramway Co. from interfering with the defendants' cable. Witness added that when the defendants' cable was cut, representatives of Messrs. Woodward, Grosvenor & Co. were not present.

"Don't you think it would have been fairer to have notified them of your intention ?" asked counsel.

Witness said he saw no reason why they should be present.

MR. JUSTICE ROWLATT : I can tell you a very good reason ; it might have avoided a conflict of evidence in this case.

MR. YOUNG : I put it to you, that this alleged injury to your tramway is make-believe. Do you swear there was any serious injury to your tramway between September 2nd and 16th ?

MR. CHARLTON : I do ; the concrete foundation over the tunnel had gone in.

So as seriously to interfere with the tramway ?—Yes.

Did the cars continue to run until you took up the rails ?—They did.

And was there, in your judgment, any danger in allowing them so to run ?—That was the reason we took the rails up ; the rails were springing.

MR. HAROLD NORTH, chief assistant engineer to the Tramway Co., gave evidence that the soil was all sand, and if disturbed, it would not stand pressure. Eight or nine days after the tunnel was cut, he noticed the tramway setts had sunk about 2½ or 3 in.

Cross-examined : His attention was not called to this part of the tramway before the tunnel was cut.

ROBERT CLARKE, permanent-way engineer to the Kidderminster Tramways Co., gave evidence as to the nature of the soil under the tramline and the work done by the defendants in relation to driving the tunnel. He said that after the work he noticed that there was vibration in the sets.

Under cross-examination, witness said there was observable sinking of the setts before the tunnel was cut, but not to the extent of 2 or 3 in. He thought the hole should have been timbered.

Other evidence of a similar character was given, and the hearing was again adjourned.

On the case being resumed on Thursday, further evidence was called for the plaintiffs to show that the tunnels had caused fractures and cracking in the concrete bed of the tramline, which necessitated renewals. The subsoil beneath the concrete through which the tunnel had been driven was of a loose character, being soft gravel and sand.

BERTIE FRENCH, installation foreman employed by the plaintiff company, stated that on examining the tramline at Worcester Cross on September 8th, he found that the setts were opening and sinking, a condition of things which was not due to ordinary wear, but to some undermining of the foundation. He assisted in opening up the ground where the defendants' cable had been laid, and when he got into the trench he assisted in cutting the cable until he was stopped by the police.

MR. JUSTICE ROWLATT : When that cable was covered up would it have been a danger to the tramway ?—Not provided it had not gone wrong.

His LORDSHIP : Why did you dig down to it ?—To put concrete in.

His LORDSHIP : But you did not want to put concrete as deep as that ?—My instructions were to put in 6 ft. of concrete.

His Lordship: Was not your object to get down there to cut the cable?—Not to my knowledge.

Several labourers who had worked in repairing the line and digging out the trench gave evidence as to the nature of the subsoil through which the defendants' tunnels were cut.

Mr. Edward Fitzmaurice, permanent-way engineer for the British Electrical Federation, also gave evidence as to the nature of the soil, and expressed an opinion that the tunnel through which the cable was taken was not a suitable form of tunnel, having regard to the fact that it was beneath the tramway.

The hearing was continued on Friday and Saturday, when Mr. Hugo Young opened the case for the defendants, and called evidence.

On Monday judgment was given for the defendants in the first action by the Tramway Co. against Woodward, Grosvenor & Co., and for the plaintiffs in Woodward, Grosvenor & Co., against the Tramway Co.; damages £100.

(To be concluded.)

War Office *v.* Kirkland & Capper, and J. H. T. Woodd.

(Continued from page 569.)

Continuing his evidence regarding the lead-covered wire, Mr. Patchell said that in one instance the wire seemed to have been bent till it had burst, and it was badly knocked about in other places. It had been handled a good many times, but it looked as if the lead was eaten away at one point; it had been "pitted," most likely, by electrolysis through leakage. If carried round rough walling and sharp corners, this lead-covered wire would be cut; the insulation on the wire itself was not good enough to be watertight without the lead covering, and if there was any damp it got through the lead covering to the wire, and the insulation broke down. If the lamps were not changed, and there was no leak on the circuit, the employment of a fuse wire of unduly low resistance did not matter a bit. He did not see how the alleged failure to keep the distribution boards clean could account for the mischief, if the distribution boards had been properly finished and connected up. It was apparently quite a chance that the faults developed where they did, and he had very little doubt that if the installation had been continued with, other faults in it would have developed. If the system was the same throughout, and done at the same time with the same workmen, he thought they were justified in abandoning the whole of the work of that type.

Cross-examined by Mr. Walter, K.C., Witness said that large quantities of lead-covered wire were used; he had used lead-covered wire himself, and had had no trouble with it. Its use was provided for in the I.E.E. regulations. Ordinary lead-covered wire was, generally speaking, of a lower grade of insulation, and the insulation more or less depended on the lead covering being kept intact.

There is nothing wrong with lead in plaster provided the work is properly done?—It need not necessarily break down if the work is properly done.

Witness said he did not know of cases of bare wire being laid in plaster. He had seen in very old work cases of insulated wire without lead covering.

Electrically plaster is an insulator?—Yes, of a low quality; it is hygroscopic, that is the difficulty.

Do you know that the Westminster Electric Co. test between poles and not only between the wires and the earth?—I do not.

If in fact the Westminster Electric Co. tested between poles, shorts would be indicated on that test?—If all the switches were put on, certainly.

If those tests took place and the company were perfectly satisfied on those, that would show that at that time there were no shorts between the mains and no shorts to earth?—Certainly.

A test with the megger would show if there was a leakage?—Yes, but a leakage is not shorting.

The hearing was adjourned after the conclusion of the evidence until next term, owing to the illness of Mr. Justice Lawrence.

(To be continued.)

Electric Sign Case Settled.

A scheme for the erection of an electric sky sign was, on April 2nd, the subject of an action before Mr. Justice Darling in the King's Bench Division, in which Wm. Henry Drucquer, a tobacconist, of Elgin Avenue, Maida Vale, and Frederick Edward Coe, of Mount Vernon, Hampstead, sued Jacob Weak, of Berlin, for alleged breach of agreement to provide money for the erection of an electric sky-sign by A. B. Carter & Co., Ltd., in which the parties were jointly interested.

Mr. V. P. Valletta and Mr. H. A. Levinson were for the plaintiffs, and Clavell Salter, K.C., Mr. Cecil Walsh, K.C., and Mr. Perhals Phillips were for the defendant.

Mr. Valletta said that the agreement sued upon was one made verbally in June, 1911, and the plaintiffs and the defendant, it was said, were to contribute one-third shares of a fund for the purpose of financing A. B. Carter & Co., Ltd., in the matter, each of the parties being directors of the company.

In his defence, Mr. Weak, in the first place, denied the making of the contract as alleged, and alternately gave reasons why, in his view, he was entitled to repudiate it.

After Counsel had opened his case, his Lordship saw Mr. Valletta and Mr. Clavell Salter in his private room, and a settlement was arrived at.

It was announced that the settlement put an end to all matters in dispute between the parties without any admission of liability.

Long Eaton Gas Co. *v.* Long Eaton District Council.

On Friday last, in the Chancery Division, there was opened before Mr. Justice Sargant the action of the Attorney-General at the relation of the Gas Co., which was brought to decide whether the Council were justified in making a differentiation of charges between consumers of their electric supply. The hearing was continued on Monday, and the case stood adjourned to the following day.

Allis-Chalmers Co. *v.* The Fidelity and Deposit Co. of Maryland.

In the Court of Appeal, on April 3rd, Lord Sumner, Lord Justice Kennedy and Mr. Justice Lawrence gave judgment in this case, on the appeal of the defendant company against a judgment of Lord (then Mr.) Justice Phillimore. The matter was reported in our issue of March 20th.

Mr. Sanderson, K.C., and Mr. McCardie appeared for the applicant company, and Mr. Sankey, K.C., and Mr. Bernard Lailey for the respondent company.

Lord Sumner, in the course of a lengthy judgment, said the questions were, when was there a concluded contract, and if there was one before April 18th, when did the risk under it commence. As to whether the terms of the contract had been agreed and a bargain completed before April 18th, the commencement of the term of insurance was fixed in the plaintiffs' own proposal. They applied for the insurance to commence from the "issuance" of the bond. Assuming that "issuance" was referred to merely for the purpose of fixing the date to be inserted in the policy—and other modes of fixing it might have been adopted, for example, the date of the policy itself, or the first of the following month, or any other date—still, whatever "issuance" meant, that fixed the date as the commencement of the insurance, and if any other date were inserted, the policy stated something never agreed and in a material respect expressed a contract that never was made. It was this policy alone that was sued upon, and rectification was not asked for. "Issuance," they were told, was a word originating in the United States of America, where both parties had their head offices. It was a new word to his Lordship, and the Court must do the best they could with it. He took it to mean a somewhat imposing kind of issue. The printed proposal form on which the word was used was prepared by the defendants. The actual word "issuance" was inserted by the plaintiffs in writing. The printed form spoke in one place of the bond being executed; in another, of it being issued, and issued to the assured. In ordinary speech the two words indicated different things, and "issuance" corresponded to the latter. If the policy when executed had been left on the table, or given to a clerk to make up for the post, or taken by a messenger to Paris, the last thing that one would have said of this executed policy—an agreement signed by one party only—would have been that it had been issued. It could never have ceased to have been in the defendants' sole control, and they might have recalled, destroyed or altered it at any time. It was no more when sent to the Paris branch by post. He could not think there was any issue or issuance of the policy until at least it was ready for delivery to the opposite party, and actual notice of that readiness had been given to him, or probability, until there was actual delivery. The date mentioned in the policy for the commencement of the risk was the date of the execution of the policy, November 8th, 1912, and the date of its termination unless renewed, November 7th, 1913. But intimation that the policy had been executed and was at the assured's disposal took place at the earliest on March 9th, and unless Lochenies had authority to receive such information on the plaintiffs' behalf, which his Lordship doubted, there was no intimation to the plaintiffs at all till March 18th. That being so the policy stated a term, viz., the commencement of the risk which it was essential to get agreed, and stated it in a way that contradicted instead of conforming to the plaintiffs' proposal. Regarded as a counter offer by the defendants, this term was never agreed by the plaintiffs before the month of April, 1912, and the loss was not covered by the insurance. If the transaction was regarded as a bargain under which the risk was only to begin when the policy was delivered to the plaintiffs, again the loss was not covered by the insurance. In either case the result was the same. At the date of the defalcations by Lochenies the plaintiffs were not covered. The critical matter was whether the term "issuance" was satisfied by the act done by the defendants on March 8th, so as to warrant the insertion of that date in the policy and make the risk commence then, and in his opinion it was not. Accordingly the appeal succeeded.

Lord Justice Kennedy concurred.

Mr. Justice Lawrence dissented. It was said that "issuance" must be said to be actual delivery, or at least the passing of the policy out of the power of the insurer, but he could not give the word such a meaning. The defendants read "issuance" as the date of the execution of the bond, and they inserted not only in the bond itself, but in their books, the same date, namely, March 8th, 1912, as the date that the risk commenced, and March 7th, 1913, as the date when it terminated. In his opinion, there was no other way of construing "issuance" in a business sense. He thought the appeal should be dismissed.

By a majority of the Court, the appeal was allowed, and judgment entered for the defendants, with costs.

Charing Cross, West End & City Electricity Supply Co., Ltd. *v.* London Hydraulic Co., Ltd.

The appeal of the defendant company against a judgment of Mr. Justice Scrutton, already reported in these pages, was heard in the Court of Appeal this week. The appeal was dismissed with costs.

PARLIAMENTARY.

London United Tramways Bill.

The Bill promoted by the London United Tramways Co. came before the Select Committee of the House of Commons, presided over by Mr. Walter Guinness, on March 31st and April 1st and 2nd. The Bill provides for agreements between the company and other bodies for the working of tramways and light railways, provision for through bookings, the carrying of a greater number of passengers on tramcars, the running of trailer cars, &c.

Mr. Balfour Browne, K.C., appeared for the promoters, and explained that the opposition was in respect of the powers sought to enable the company to enter into agreements with the various local authorities, and to enable each local authority, if it thought fit, to postpone, for a period not exceeding 42 years, the date at which it had a right to purchase the tramways in its area. One clause provided that as regarded Surbiton, Isleworth, Teddington, Hampton Wick and Twickenham, who were concerned in the Hampton loop section, neither could enter into an agreement without the consent of the others.

Mr. J. Devonshire, managing director of the company, gave evidence in support of the Bill, and said that its main object was to enable bargains to be made with the local authorities, under which, in return for an extension of the time of purchase, road widening and improvements might be desirable.

In cross-examination, by Mr. Fitzgerald for the Middlesex County Council, witness denied that the object was to get an extension of period to enable the company to deal with its financial burdens.

Mr. Fitzgerald contended that if the power was granted it would enable a number of local authorities to override the general Tramway Act, and the action of one authority might prejudically affect the interests of others.

The Committee struck out the portion of the Bill dealing with power to make bargains with the local authorities.

Evidence was then heard for a clause giving the company power to use trailer cars, and Mr. A. L. C. Fell, manager of the London County Council Tramways, expressed the view that congestion of traffic was decreased by the use of trailers.

The Metropolitan Police authorities opposed the application on the ground that it would result in further congestion.

The Chairman said the Committee had open minds on the question, but they were not prepared to give the company power to run trailers in contravention of any existing agreement with a local authority.

Mr. Macassey said that the tramways of the company ran through the districts of 23 local authorities, but there were only agreements of the nature referred to with Wimbledon and Kingston.

The Committee eventually passed the clause subject to conditions. These were that the question of running trailer cars at Ealing should be left to the Board of Trade; that trailers should not be used in the neighbourhood of the depôts at Surbiton; and that the Board of Trade should consult the local authorties of Teddington and Twickenham with regard to the running of trailers in those districts.

The Bill, as amended, was ordered to be reported for third reading.

Houghton Gas and Electricity Bill.—The Standing Orders Committee has agreed to suspend the Standing Orders to allow of the promoters inserting an additional provision.

Second Reading.—In the House of Commons, on April 1st, the L.C.C. (Tramways and Improvements) Bill was read a second time.

BUSINESS NOTES.

Consular Notes.—CHILE.—In a recent report the British Consul at Valdivia states that the business in machinery, for the obvious reason that it necessitates a large lock-up of capital, is in the hands of local branches of large Valparaiso and Concepcion firms. Manufacturers who address the Valdivia Consulate with a view to securing local representation for the sale of their machinery, are in most cases merely wasting time; they should address Valparaiso firms, or their British or Continental shipping agents, with the object of securing representatives for the sale of their machinery throughout the whole of the country. As regards catalogues, they must bear in mind that the provinces of Valdivia and Llanquihue are largely populated by Germans and the descendants of German settlers; if they have no Spanish literature to dispose of, they should send German, or even French (there are a number of wealthy and influential Basque merchants established in the neighbourhood), resorting to English as the last extremity, for among the Chilian-Germans English is little known. The German goods are preferred, and that the many local German merchants should have inculcated the natives themselves with a liking for their wares, is only natural; this may be better understood when it is stated that for shipping purposes, whatever be the line of goods required, a knowledge of the German language is as serviceable as a knowledge of Spanish. Of the three largest firms established in Valdivia, however, two are British and one American (all three have important London connections), and these three firms have a large *clientèle*, composed in the main part of German merchants (wholesale and retail) and German farmers.

AFGHANISTAN.—In a recent comprehensive report on the trade of Afghanistan, a Special Commissioner of the United States Government states that interesting evidence as to the awakening of the closed country of Afghanistan to modern progressive ideals of civilisation is to be found in important construction works now being carried out under circumstances of great difficulty, especially those connected with costly and difficult transport of needed machinery and other material. The most interesting development of this sort is a project now under way for transmitting electrical energy at 44,000 volts from a waterfall about 120 ft. high to Kabul, the capital, situated about 40 miles away. This development is in charge of an American engineer, Mr. A. C. Jewett, formerly an employé of the General Electric Co., Schenectady, N.Y., who was more recently chief engineer for the important hydro-electric development in the State of Kashmir, India.

This hydroelectric scheme will cost between £100,000 and £125,000 when completed, of which about £60,000 will be spent for machinery and materials. The water-power obtained will be used for distributing cheap electrical energy to the gun factory, shoe factory, projected woollen mill, and other industries at Kabul, under the control of the Government of His Majesty the Amir; also for electric lighting of the royal palace, other residences, and Government offices and streets. The machinery and material, including switches, generators, steel towers and copper-covered steel wires, are being imported chiefly from the United States. The contract for this work is held by the Bombay firm of F. and C. Osler, Ltd. (also of Broad Street, Birmingham, England). The development should be of particular benefit to the industries of Kabul, which are now greatly handicapped by the excessive cost of fuel. There are no coal mines in the country and wood is also very scarce; for factories at Kabul wood has to be carried for many miles on the backs of camels. The difficulty of transporting the needed machinery and ironwork through the Khyber Pass and over the almost impassable road, a large part of the way to Kabul, is greatly delaying the project, which may require several years more to complete, although work was begun over a year ago. The attempt to use motor lorries imported for this purposes has failed, owing to the bad condition of the road to Kabul, and it is only by use of elephants that the heavy and bulky articles required can now reach Kabul. Local labour, under the direction of the American engineer and two well-qualified assistants, is being used on this work.

POLAND.—The British Consul in Poland reports that trade between that country and the United Kingdom appears to be increasing, if reliance can be placed on the numerous new lines of business which appear to be connecting the two countries. The attempts which have been made during the last few years to open direct connections without the intervention of the German middlemen appear to be succeeding to a certain extent, and there is much evidence to show that a sentiment favourable to such a condition of affairs is gaining ground, both locally and in the United Kingdom. A possible means of assisting these aspirations may be found in altering the system of collecting acceptances and drafts, which, at present, requires the medium of one of the German banks, involving the payment of two or three bank commissions, and a similar number of losses by exchange from sterling into marks, from marks into roubles and *vice versâ*. So long as such acceptances are drawn in Russian currency, the Imperial State Bank in Warsaw, whose commission is very small, is willing to make the collection and remit by cheque on London in sterling. This method has the advantage of circumventing various expedients adopted by unscrupulous persons for delaying or not meeting their obligations, as in the event of the acceptances not being met at once, their credit is cut off and cannot be re-established for some years. It is not necessary for British firms to keep any deposit for this purpose at the State Bank, but this bank will not discount any such bills unless the British firm has a branch in the Russian Empire and keeps a current account of proportionate sums in the bank itself.

TURKEY.—The British Consul at Smyrna reports that telephones have been put up between the police stations of that town and all the surrounding suburbs; further, a few firms have installed telephones between their head and other offices. The suburb of Boudjah has had public lighting by electricity arranged in the village, through a British firm. The municipalities of Odemish, Baindir and Kirkagatch have also had telephones put up in their towns by the same British firm. The Smyrna-Gueuztepe (Belgian) Tramway Co. is shortly to electrify its lines and light by electricity the route followed. Concessions have also been granted for an electric tramway from Smyrna to Nymphio and round the back of the town to Smyrna and for the electrification of the Quay Co.'s tramways. The concession holders are, it is understood, all ready to conider offers of firms that wish to participate in the exploitation of these projects. All those applying for concessions must appoint a reliable local agent to watch matters if they mean their application to be taken seriously.

Elsewhere in his report the Consul says that the year 1912-13 saw several exploits of the Black Band, that has for so many years operated from Smyrna and Constantinople, and has found victims in every country with which it has done business. Its methods are well known, but the caution given in previous reports needs to be repeated. The various tricks of this swindling confraternity may be tabulated as follows:—

1. Dealing honestly with one or two well-known firms and giving them as references.
2. Giving as references various bogus commercial inquiry offices

3. Giving each other as references and adopting false names, false addresses, &c.

4. Forging bills of lading, for goods ordered in Turkey when payment or part payment on receipting of bill of lading has been agreed to.

5. Sending stones, dirt or other rubbish instead of goods.

6. When importing goods from the United Kingdom, making a part payment on giving the order and then after receiving and selling the goods and being pressed for the remainder of the payment, forcing the foreign firm's lawyer to accept 20 per cent. rather than lose the whole amount by putting the swindler into bankruptcy, a proceeding which always results in finding that all the man's possessions have been long ago transferred to other names.

The British Chamber of Commerce of Smyrna has published the names of certain prominent members of the Black Band, and it seems largely due to its efforts that the Black Band has somewhat neglected the United Kingdom recently.

NORWAY.—The American Consul at Stavanger reports that the market for electrical supplies in the Stavanger Consular district is worthy of close investigation before a firm attempts to enter the field, because the laws respecting installation of electrical equipment restrict the use of many specialities. The American Edison base standard type of sockets is used. The municipal electric light plant, under the supervision of Driftsbestyrer Nannestad, is required by city ordinances to approve the electrical supplies before they may be installed. Mr. Nannestad has expressed to the American Consulate his willingness to examine any samples of American electrical specialties sent him, and will in return be pleased to report to interested firms whether such submitted supplies meet with the city's approval If they do not he will endeavour to point out wherein they are objectionable. English may be used in any such correspondence. This same city bureau, besides supervising the installation of electric apparatus, retails supplies to the trade and is naturally interested in making its purchases wherever it can do so to best advantage. The keen competition in supplying the local market must be kept in mind, especially on account of the activities of German and Swedish firms. Practically no electrical supplies in use locally are manufactured in Norway. The foreign firms supplying this market have their interests looked after by personal representatives —either travelling salesmen calling on the trade with samples or branch offices with a stock of goods. One company also has offices in Christiania, Bergen, and Trondhjem. Some of the goods are supplied through agencies located in Christiania, but even where such a sales arrangement exists, representatives are usually sent into this territory. The buildings in this district are mostly of ordinary frame construction. Although a more fireproof type of structure, either of brick or cement, is now favoured, the wiring is carried in iron conduits. In all the newer buildings, the wiring is concealed within the walls or ceilings. There are no steel-frame construction business blocks, and not a dozen buildings in the city have more than two full stories. Electric power is furnished cheaply throughout the district, due to the many available waterfalls. For this reason electric lighting is within reach of the poor, and this market is a good one for all kinds of electrical supplies. Stavanger is equipped with alternating current furnished day and night. The lighting circuits are at 130 volts and power up to 230 volts, 50 cycles per second.

Canada.—The *Canadian Electrical News* states that the Northern Electric Co., Ltd., recently incorporated with a capital of $10,000 000. will absorb the Northern Electric and Manufacturing Co., Ltd., and the Imperial Wire and Cable Co., Ltd., Montreal. "Both of the latter companies have been in working alliance, and they will now be merged under the new name, the present names of the two concerns being dropped when the new company comes into working order."

British Trade with New Zealand.—Mr. W. G. Wickham, His Majesty's Trade Commissioner in New Zealand, attended at the offices of the London Chamber of Commerce, 97, Cannon Street, E.C., last Monday and Tuesday, April 6th and 7th, for the purpose of conferring with firms interested in trade with New Zealand. Mr. Wickham is anxious to obtain the views of firms as to any matters of interest he may usefully investigate, and to afford all possible information as to trade in New Zealand.

Catalogues and Lists.—The Cable Accessories Co., Ltd., Tividale, Tipton.—Leaflet No. 35 contains illustrations and prices of a number of lantern fittings for half-watt lamps for street, station and shop lighting; No. 32 shows ironclad double-pole switch and fuses for street lighting fittings.

The Solenoid Regulator Co., Highgate Square, Camp Hill, Birmingham.—New price list of field rheostats wound with non-corrosive wire on porcelain tubes. Sketches and dimensions are given.

Messrs. Pitters Ventilating and Engineering Co., Ltd., 20, Bishopsgate, London, E.C.—Catalogue Section E (8 pages) giving illustrated particulars and tabulated prices of their silent-running "Multiblade" fans for desk, bracket, pendant, ceiling and other service. Automatic shutters and fan starters and regulators are also shown.

Messrs. Mather & Platt, Ltd., Manchester.—Twelve-page booklet describing their electrolyser for the production of sodium hypochlorite for bleaching and other purposes.

Messrs. Scholey & Co., Ltd., 151, Queen Victoria Street, London, E.C.—Supplementary price list of electric fans, desk, oscillating, ceiling and port-hole types for the coming season.

Mr. E. C. Amos, 22, Martin's Lane, Cannon Street, London, E.C. (A. Borsig, Berlin).—18-page pamphlet, also loose illustrated leaflets, giving a full description of the "Crystal" system of automatic water supply by means of "Crystal" electrically-driven centrifugal pumps. Copies will be sent on application.

Fiberloid Co., Ltd., 92, Carver Street, Sheffield.—Small 16-page pamphlet giving particulars and prices of their fiberloid (celluloid), horniloid and vulcanised fibre for electrical purposes.

The General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C.—Four new publications have been issued as follows:—Angold Bulletin 6A, fully describing the "Angold" Magazine Flame Arc Lamps; C. 1791, giving particulars of the various types of "Demon-Grip" continuity fittings; L. 1805 concerning the "Witton" 4½-volt Dry Battery, and L. 1782 describing the "Geeko" Companion Set.

Book Notices.—We have received a copy of the new issue of the "Newcastle and Gateshead Chamber of Commerce Year Book and Commercial Review (1914)," which has been published for the Chamber by Messrs. Sells, Ltd., London, at 2s. 6d. It contains maps of Newcastle-on-Tyne and Wallsend, a plan of the River Tyne, with interesting views of the river, &c. The collieries, industries, works, &c., of the district are very fully described, and there are a number of illustrated articles relating to particular firms, their works and manufactures. There is also a classified Merchandise and Trades List.

"Electric Car Maintenance." By Walter Jackson. Price 12s. 6d. net. "Elementary Magnetism and Electricity." By C. M. Jansky. Price 6s. 3d. net. London: Hill Publishing Co., Ltd.

"Report of the University College (University of London) Committee, 1913-1914." London: The University.

"Annales des Postes, Télégraphes et Téléphones." March. Paris: A. Dumas. Price 10 fr.

"La Lumière Electrique et ses Différentes Applications au Théâtre." By V. Trudelle. Paris: Dunod & Pinat. Price 10 fr.

"*Bulletin* Mensuel de la Société Belge d'Electriciens." Vol XXXI. March. Brussels: E. Bruylant. Price 1 fr. 75.

The *Scientific Review* is a new "non-technical, popularly-written review of all that is newest in Science and Technology throughout the world." For its objects we have the fullest sympathy; its contents range from wireless telegraphy to sewage treatment, and a great variety of subjects is dealt with more or less fully. But in spite of the advance of science into every domain of modern life, it is manifest rather by its products and results than by its methods to the layman, who as a rule cares little about the means by which his comfort is enhanced, and is easily bored by an explanation of the how and why. Our new contemporary, therefore, will have an uphill fight, in which we wish it every success.

Private Arrangements.—Marbro, Ltd., electrical accessories manufacturers, 22, Belsham Street, Morning Lane, Hackney, N.E.—The creditors interested herein were recently called together when the Receiver for the debenture-holders reported that he had also been appointed to act as liquidator of the company. He presented a statement of affairs which showed liabilities to cash creditors of £1,067 while there was £940 due to the trade. In addition there were preferential claims for £60. first debentures for £1,000, and second debentures for £250. The assets were estimated to realise £2,676, and consisted of stock in trade, £600; machinery, &c., £1,500; tools. £76; furniture and fixtures, £100; and sundry debtors, £400. It was stated that if the company was wound up compulsorily, the assets would probably not realise anything like the amount at which they were set down. An offer had been received to purchase the business for £1,000, and in addition an undertaking would be given to pay the trade creditors in full by four equal instalments, the first to become payable on April 1st. In the event of the offer being accepted, the second debenture-holders would defer their claims, and the cash creditors would do the same. After a short discussion, the offer made was unanimously accepted.

Trade Announcements.—The Atlas Electrical Co., Ltd., have removed to larger premises at 58, High Street, Charing Cross Road, W.C., where they will carry large stocks of "Atlas" metal-filament lamps and electrical accessories of every description.

Messrs. F. K. Osterman & Co., of 5, Bond Street, Vauxhall, London, S.W., are just opening an extended electrical department, with showrooms, carrying stocks of electrical machinery and accessories. Installation and dynamo and repair work are features of the business.

The Hart Accumulator Co., Ltd., announce that Mr. T. H. Valentine, of 38, Dame Street, Dublin, does not now represent them as their agent in Ireland.

Mr. Geo. Cooper, electrician and contractor, late of White Hart Street, has purchased the entire stock of Mr. John Wooley, and has removed to his premises at 32, Clumber Street, Mansfield.

Messrs. John Dugdill & Co., of Failsworth, have opened large show and salerooms for their patent movable fittings at 41A, Mosley Street, Manchester (opposite the Chamber of Commerce). They invite firms to send them catalogues (with discounts) of allied goods, not movable fittings.

The Electrical Supplies Co. have removed from Cheapside to larger premises at 53, Victoria Street, Westminster, S.W.

Bankruptcy Proceedings.—C. Blake (Bilston Electrical Co.), electrical engineer, Bilston.—Last day for receiving proofs for dividend, April 22nd. Trustee: Mr. S. W. Page, 30, Lichfield Street, Wolverhampton.

Dissolutions and Liquidations.—The Electromobile Co., Ltd.—This company is winding-up voluntarily, with Mr. Stewart Cole, of Sardinia House, Kingsway, W.C., as liquidator. A meeting of creditors is called for April 16th at the Connaught Rooms, Great Queen Street, W.C.

Limbrey, Martin & Co., electrical engineers and contractors, 38, Gondar Gardens, West Hampstead, N.W.—Messrs. F. E. Limbrey and A. R. Martin have dissolved partnership as from December 31st, 1913. Mr. Limbrey will attend to debts, and carry on the business under the style of Limbrey & Co., at the same address.

LIGHTING and POWER NOTES.

Bacup.—Street Lighting.—The T.C. has decided to electrically light the whole of the Rochdale Road route within the borough. It was also resolved to supply electricity for power and lighting purposes to Messrs. John Hargreaves, Ltd. Tenders are to be obtained for the overhead equipment for the supply of electricity to street lamps, to be suspended from the tramway wires.

Bawtry and Barmborough.—Street Lighting.—The Doncaster R.D.C. has decided to apply to the L.G.B. for powers to carry out a street lighting scheme in the district with electricity obtained from the new colliery company. Messrs. Best & Turner, of Bradford, are to be asked to provide an E.L. scheme for Bawtry and Austerfield, and district.

Bootle.—Street Lighting.—The T.C. has decided to light Aintree Road by electricity at an estimated cost of £377.

Bradford.—The Electricity Committee has sealed an agreement with the Yorks. E.P. Co., with reference to a supply of electricity in bulk to Messrs. Waterhouse, of Norwood Green.

Chorleywood.—The U.D.C. has sealed an agreement with the Colne Valley E.S. Co., relating to a supply of electricity for the district, and which empowers the Council to purchase the undertaking within 21 years, or at the expiration of any subsequent seven years.

Continental Notes.—Italy.—La Società Italiana per il Carburo di Calcio last year produced 33 tons of calcium carbide at its works at Papigno and Narni. The company, in addition to its manufacturing business, also supplied approximately 32 million kw.-hours from its hydro-electric stations to the Gas Co. at Rome, and has contracted to supply the Società Volsina d'Elettricita with power to the extent of 2,500 kw. as from the commencement of 1915, increasing to 10,000 kw. in 1922.

Norway.—The municipality of Gloppen, in Western Norway, has recently acquired the water rights of the Breim River, which is estimated to give some 9,000 h.p. It is intended to develop a small power for local use, and the remainder when large consumers require it.

Switzerland.—A syndicate, including the Rhätischen Bahnen, the Kanton Graubunden, the Motor-A.G., Baden, and the Eisenbahnbank, Basle, has been formed to utilise the water-power of the upper Albula, the Julia and the Landwasser at Mühlen. An advantageous concession has been arranged with the Communes of Mühlen and Roffna, and the consent of the Grisons Canton is about to be given. It is expected that the municipality of Zurich will interest itself in the scheme. It is proposed to erect a dam collecting 2,300 million cb. ft. of water. A large hydro-electric station will be built, and the lower lying country will be safeguarded from damage by flood.—*E.T.Z.*

Cranbrook (Kent).—Overhead Wires.—The R.D.C. has referred the application of Messrs. J. B. Saunders & Co., of Westminster, for permission to utilise overhead wires for an electricity supply for Cranbrook and Hawkhurst, to the respective Parish Councils.

Dumbarton.—Electricity Works Fire.—According to the *Belfast Evening Telegraph*, the Dumbarton T.C.'s electricity works was damaged by fire on April 1st; the damage is estimated at £1,200.

Eastbourne. — Proposed Mains Extensions. — The E.L. Committee has recommended the T.C. to adopt the borough electrical engineer's report, proposing an expenditure of about £4,656 on alterations to the distributing system.

Flockton.—L.G.B. Inquiry.—An inquiry has been held by Mr. H. R. Hooper into the application of the U.D.C. to borrow £480 for the purpose of public lighting; the Council is proposing to adopt a scheme of the Yorks E.P. Co., and is also considering a scheme for private lighting.

Frant.—Proposed E.L.—The Tunbridge Wells T.C. has asked the borough electrical engineer to report on a request by Messrs. Saunders & Co., for terms for a bulk supply of electricity to Frant.

Leeds.—Electricity Works Extension.—The City Council on Wednesday, last week, gave its approval to the £200,000 scheme for the extension of the electricity works.

Leyton.—There is a surplus of £1,188 on the electricity undertaking for the year ended March 31st last, as compared with an estimated deficit of £368. The surplus for the year ending March 31st, 1915, is estimated at £565.

London.—Marylebone.—With regard to the alleged failure of the Electrical Power Storage Co. to properly carry out its maintenance contract in respect of the Rathbone Place storage battery, the Electrical Supply Committee states that the company is not disposed to carry out the necessary works, alleging that the bad state of the battery is due to the Council's improper usage. The Committee has decided to submit the matter to arbitration.

L.C.C.—The report of Mr. C. H. Merz, bearing on the future of the supply of electricity in London, has been received by the Council and is to be placed on sale.

Lurgan.—B. of T. Inquiry.—Mr. G. B. Deane held an inquiry last week into the application of the U.D.C. for authority to expend £12,000 on an E.L. scheme. The Lurgan Gas Light and Chemical Co., and the Ratepayers' E.L. Committee opposed the scheme.

Mansfield Woodhouse.—Street Lighting. — The U.D.C. has decided to light Morven Avenue with nine double 50-c.p. electric lamps, the current to be supplied by the Mansfield Corporation.

Middleton.—Proposed Loan.—The T.C. has been recommended to apply for a loan of £6,000 for extensions at the electricity works, to accommodate transformer plant in connection with a supply of electricity from Manchester for distribution in the borough.

New Zealand.—The Dunedin Corporation proposes raising a loan of £150,000 in connection with the extension of its electricity undertaking, and for the provision of an auxiliary plant; this, however, has been anticipated to the extent of about £112,000, so that only about £38,000 remains to be spent.—*Board of Trade Journal.*

Oulton Broad.—Prov. Order.—The Electricity Co. having asked the B. of T. to dispense with the consent of the U.D.C. to a prov. order for electric supply, a meeting has been arranged between the Council and the company, and the Council has decided to ask for a clause giving it power to acquire the undertaking at any time after 15 years from the granting of the order, and, if desirable, to effect a compromise with regard to the period named.

Redcar.—Proposed E.L.—The U.D.C. has appointed Messrs. A. W. Valon & Son to advise it generally on the question of E.L.

Rochester.—Organ Blowing.—Work has been commenced on the substitution of electric power for the hydraulic power used for the organ in Rochester Cathedral; the old plant obstructed three arches in the crypt, which will now be cleared, the electric motor being placed in an adjoining arch.

Saddleworth (near Oldham).—Proposed E.L.—A meeting of the U.D.C. and large mill owners has appointed a Committee to formulate an electricity scheme for the district.

Tenby.—Proposed E.L.—The T.C. has decided to apply to the B. of T. for a prov. order for E.L. in the borough.

Treeton.—Street Lighting.—The P.C. has accepted the terms of the Rothervale Colliery Co. for a supply of electricity for new public lamps in the village at 2d. per unit.

Turton (Lancs.).—Cottage Lighting.—A canvass is being made to see what support can be got for a scheme for the lighting of small cottages by electricity at a fixed charge of 7s. per quarter, with no restriction as to consumption.

Warrington.—Loan Sanction.—L.G.B. sanction has been received for the borrowing of £14,531 for extensions of plant and buildings at the electricity works.

Wick.—The T.C. has granted wayleaves to Messrs. Edmundson's Electricity Corporation for an electric lighting undertaking in the town.

York.—Workhouse Lighting.—In consequence of the saving effected by the use of electricity in some departments of the workhouse, the B. of G. intends, when the opportunity arises, to install E.L. throughout the building.

TRAMWAY and RAILWAY NOTES.

Australia.—The financial statement of the Adelaide S.A., Municipal Tramways Trust for the half-year ended January 31st last, shows total revenue receipts amounting to £163,720; working expenses, £101,477; and a balance to credit of this account of £62,243. The full statutory charges for the half-year amounted to £61,153, and the balance of net revenue was £62,629, leaving a surplus for the half-year of £1,476. The reserve for renewals now amounts to £58,039, and for insurance to £6,004; the sinking fund account amounts to £86,346. The gross revenue was £8,277 more than in the preceding half-year. We are indebted to Mr. W. G. T. Goodman, the chief engineer, for these particulars.

Aberdeen.—Magnetic Brakes.—On the recommendation of the tramways manager, the Corporation is to purchase magnetic brakes for eight of its tramcars from the B.T.H. Co., at a cost of £288.

Bradford.—Year's Working.—The total receipts of the Corporation tramways for the past year amounted to £308,138, against £289,616 in the previous year. The passengers carried numbered 67,651,839, an increase of 5,645,863; the car-miles run were 6,255,878, an increase of 284,317, and the receipts per car-mile were 11·82d., against 11·63d.

Continental Notes.—Norway.—A company has been formed with £47,500 capital to build an electric railway ("Ekebergbanen") to Ljan. The line will be 3½ miles in length, and will work in traffic connection with one of the two tramway companies now operating in Christiania. The constructional cost is estimated at £47,500, the car-miles at 280,000 per annum, the receipts at £12,500 per annum, and the profit, after allowing interest and depreciation, at £5,000 per annum.

Crompton.—The Tramways Committee has decided to interview the Oldham Tramways Committee on the question of the extension of the Oldham system, and the obtaining of powers to connect the tramways between Shaw and Newhey.

Gateshead-on-Tyne.—The T.C. is to withdraw its opposition to the N E Railway Co.'s Bill for the running of railless electric trolley cars over the high-level bridge, subject to protective clauses relating to road maintenance being inserted.

Glasgow.—All-night Service.—The Tramways Committee has decided to begin a service of all-night cars on 16 of its routes in the autumn.

Halifax.—Year's Working.—The income of the Corporation tramways for the year ended March 31st, 1914, was £109,666. The expenditure was £95,416, leaving a profit £14,250. The passengers carried numbered 20,276,077, and the car-mileage was 2,242,086 miles.

Leeds.—Annual Accounts.—The total receipts of the T.C. tramways department for the year ended March 31st, 1914, were £427,261, an increase of £15,930 over the previous year. Ninety-four million passengers were carried during the year, and the car-mileage was 9,204,331 miles. The receipts per car-mile averaged 11·145d.

Liverpool.—New Type Cars.—The Tramways Committee has adopted a new type of tramcar which is ultimately to supersede the present type of rolling stock. The new type was designed by Mr. C. W. Mallins, the general manager, and is an improvement on the present stock in comfort and appearance. The double entrance and exit system is retained, and accommodation is provided for 80 people. The passages between the seats both on top and inside are wider, and the lighting and ventilation are on an improved plan.

Newcastle-on-Tyne.—Rate Relief and New Cars.—At a recent meeting of the City Council, called to consider the municipal rates, Councillor Adams criticised the action of the Tramways Committee in granting £18,000 in relief of the rates, and, at the same time, seeking powers to borrow £12,240 for the purchase of new cars. Ald. Rodgers said the proposal to acquire new cars was an outcome of the extensions that had taken place, or were likely to take place in the future, if they got their cars running to Benton; they were not replacing old cars, and the expenditure, as in laying the lines would be capital expenditure, and, fairly, ought to be defrayed out of borrowed money. In the last seven years they had rebuilt 51 cars out of revenue and reserve, and had built 15 absolutely new cars, but they could not go on building out of their revenue. Mr. D. Adams said, despite the statements made by Ald. Rodgers, he was still going to move that the report of the Tramways Committee be sent back for further consideration. Ald. Rodgers said it was folly to think that the present-day ratepayers should be taxed in order that the ratepayers of 15 or 20 years hence should be given a free tramway service. That would be what they would be doing if they were to build new stock out of revenue. The amendment was rejected, and the report was carried.

New Zealand.—The Dunedin Corporation proposes to purchase three electric omnibuses for use in connection with the tramway system, to double a portion of the present tramway line, and to construct additional cars.—*B. of T. Journal.*

Rochdale.—Year's Working.—During the year ended March 31st, the receipts on the Corporation tramways, including the Heywood system, amounted to £83,176, an increase of £2,830 over the preceding year. The passengers carried numbered 14,584,777, an increase of 844,625, and the mileage run was 1,788,030, an increase of 39,063.

South Shields.—Year's Working.—During the year just ended, the number of passengers carried was 1½ millions in excess of the previous year, the receipts increased by £4,000, and the car-mileage by 83,000. As the result of adopting 1d. return tickets, 12,000 tickets a week were sold, as compared with 4,600 1½d. return tickets per week formerly; in the same way, by dropping the price of four-journey tickets from 3d. to 2d., the number per week increased from 280 to 1,600. Application is to be made for a provisional order to extend the tramways to the borough boundary at Harton and to the top of Mile End Road.

Wallasey.—Tramway Extensions.—The Tramways Committee has recommended that provision be made in the proposed Bill for the construction of a tramway from New Brighton Pier, along the promenade to Harrison Drive, and to the existing tramway at Grove Road, and for a service of motor-omnibuses.

Wigan.—Year's Working.—The income of the T.C. tramways department for the year just ended was £78,000, as against £71,289 for the previous year. The car-mileage was 1,500,846, an increase of 51,658.

Wimbledon.—The T.C. Law Committee has decided to withdraw its opposition to the L.U.T. Bill, 1914, provided that the tramway along part of St. George's Road is abandoned, and that trailer cars shall not be run within the borough, except at certain times, without the Council's consent.

TELEGRAPH and TELEPHONE NOTES.

Australia.—The public has made little use of the coastal stations, which are costing for maintenance at the rate of something like £800 a year each, and collecting a revenue of scarcely £80, on the average. The P.M.G., therefore, has reduced the charges from 10d. to 6d. a word, to increase the traffic.

Berlin-Milan Telephone.—The telephone service between Berlin and Milan was opened on Wednesday last week. On Tuesday this week, it was extended to Rome and eight other towns.

Imperial Wireless System.—On Thursday last week, the last public sitting of the H. of L. Committee on Lord Murray's transactions, was held, and the accusing counsel delivered their closing addresses.

Semi-automatic Telephony.—It is stated that the semi-automatic telephone exchange at Dresden is the largest of its kind in the world, being capable of affording provision for up to 100,000 subscribers; the number of connections at present is 16,000. The Dresden exchange was commenced shortly after the opening in 1912 of a semi-automatic exchange at Posen; two further exchanges on the semi-automatic system are being erected at Liegnitz and Leipsic respectively.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdeen.—April 15th. Installation of electrically controlled clocks in the new station for the Joint Station Committee. Specifications (10s. 6d.) from Mr. J. A. Parker, 80, Guild Street.

Australia. — May 12th. P.M.G.'s Department. Standard batteries for all States; Schedule No. 1,010. See "Official Notices" April 3rd.

Victorian Railways.—May 13th. One hundred enclosed arc lamps. Deposit £5. Mr. E. B. Jones, acting secretary.

May 20th. Victorian Railways Commissioners. One three-phase slip-ring electric motor and accessories. Deposit £1. Local representation. A specification can be seen at the B. of T. Commercial Intelligence Department in London.

Melbourne.—April 27th. Overhead travelling cranes for sub-stations and lifting tackle for power stations, for Melbourne Suburban Railways. See "Official Notices" April 3rd.

Ballymena.—April 11th. B. of G. E.L. installation at workhouse and supply of steam engine, 20-kw. dynamo and steam pumps. Specification from Mr. F. D. Brown, Engineer, 93, Ann Street, Belfast.

Belgium.—May 6th. The municipal authorities of St. Nicholas (Province of Liége) are inviting tenders for the concession for the public and private electric lighting of the town.

Bootle.—April 22nd. Corporation. Supply of two 500-600-kw. rotary converters, transformers and switchgear for the electricity department. Forms of tender from the Borough Electrical Engineer, Electric Light Station, Pine Grove.

Bosnia.—Doboj.—April 20th. Municipal electric light installation for Doboj and Usora, comprising supply and erection of driving machinery, electrical equipment of the generating station, supply and erection of pumps and motors, complete distribution network for Doboj and Usora. Particulars from the Stadtgemunde, Doboj, Bosnia.

Bradford.—Corporation. Fifty tramcar bodies.

Bristol.—April 15th. Arc lamp carbons and incandescent electric lamps for a year for the Docks Committee. Mr. W. W. Squire, Engineer, Cumberland Basin.

Devonport.—April 27th. Corporation Gas Department. Electrically-driven jib crane and coal hoppers. Specification, &c. (£1 1s.), from Mr. I. Carr, Widnes.

Doncaster.—April 17th. Corporation. 1,200 tons of steel rails, also fishplates and soleplates, for Tramways Department. Specification (10s.) from the Borough Engineer, 3, Priory Place.

Dublin.—April 17th. Corporation. Twelve months' supply of arc lamp carbons. See "Official Notices" April 3rd.

Edinburgh.—April 20th. Corporation. Extension switchboard, for McDonald Road station. See "Official Notices" April 3rd.

Farnworth.—April 18th. U.D.C. Switchgear and cables. Mr. H. J. Hutchinson, Engineer, Electricity Works.

Germany.—May 1st. The municipal authorities of Farmsen, near Hamburg, are inviting tenders for the supply of 8,200 metres of electric cables.

Leeds.—May 11th. Corporation. Steam turbine, three-phase alternator and exciter, 12,000-kw., 1,000 to 1,500 r.p.m., and condensing plant. See "Official Notices" April 3rd.

E.L. installation, West Leeds Working Men's Club. The Secretary.

Leyton.—The Borough Surveyor has been instructed to invite quotations for the wiring of the Isolation Hospital.

Limerick.—April 17th. Corporation. Electrical accessories, service boxes, cables, &c. See "Official Notices" April 3rd.

London.—L.C.C. April 22nd. Installation, 218 wiring points, 283 lights, at Wilson Street Elementary School, Islington, N. See "Official Notices" April 3rd.

Fulham.—April 29th. B C. Coal for the electricity department for 12 months. Borough Electrical Engineer.

Manchester.—April 21st. Corporation. Power-driven rail-bending machine. Specifications, &c., Mr. J. M. McElroy, General Manager.

New Zealand.—May 11th. Hydro-electric and sub-station plant for Tauranga. Specification, &c., from Messrs. H. W. Climie & Son, engineers, Tauranga. Deposit £2.

Wellington.—April 15th. Public Service Stores Tender Board. 14 miles of H.D. bare aluminium cable, also binding wire, aluminium connectors and terminals, porcelain insulators, dry cells, wall telephones, &c. Particulars can be seen at the Commercial Intelligence Department of the Board of Trade, London.—*B. of T. Journal.*

Norway.—April 11th. Norwegian State Railways. Galvanised iron wire, insulated copper wire, dry batteries and insulators. Local representation. Particulars can be seen at the Board of Trade Commercial Intelligence Department in London.

Norwich.—April 14th. Corporation. Coal (12,000 tons) for 12 months for the electricity works. City Electrical Engineer.

Nottingham.—April 16th. Twelve months' supply of stores for Corporation electricity department. See "Official Notices" April 3rd.

Rathkeale (Co. Limerick).—April 18th. Gas engines and suction plant, dynamos, storage battery, switchboard, overhead lines and street lamps, for Rathkeale Electric Lighting and Power Co. See "Official Notices" March 27th.

Rochdale.—April 15th. Corporation. Boiler feed pumps and crane. See "Official Notices" March 27th.

Shipley.—April 16th. 1,500 yards of double tramway, for the U.D.C. Specifications, &c., from Mr. W. H. Dawson, Engineer and Surveyor, Council Offices.

Spain.—April 20th. The municipal authorities of Orgaz (Province of Toledo) are inviting tenders for the concession for the electric lighting of the town during a period of 13 years.

The Spanish Ministry of War in Madrid has just invited tenders for the supply of the current required for the electric lighting of the Military Barracks at Ceuta.

Torquay.—April 20th. Corporation. Two water-tube boilers, fuel economiser, steam pipes, valves, &c. See "Official Notices" April 3rd.

Tunbridge Wells.—April 30th. Corporation. 4,000 tons of small coal for use with Underfeed stokers. Borough Electrical Engineer.

April 22nd.—Corporation. 300-kw. steam prime-mover, alternator and exciter, condenser with air and circulating pumps. See "Official Notices" April 3rd.

Tyrol.—Hall.—May 2nd. Installation complete of a single-phase mine railway in the State salt mines; also supply of a single-phase alternating-current locomotive and 15 iron mine trucks and a revolving tipper. Particulars of the K.k. Salinenverwaltung, Hall, Tyrol.

Walthamstow.—April 24th. U.D.C. One water-tube boiler and pipework, overhead bunkers and conveying plant, cast-iron circulating water pipes, for the Electricity Department. See "Official Notices" April 3rd.

Warrington.—April 14th. One year's supply of motors and transformers, for the Borough Electricity Dept. See "Official Notices" March 27th.

April 16th.—Corporation Gas Department. Switchboard, distribution board and wiring. Mr. W. S. Haddock, General Manager, Gas Offices.

Wigan.—April 18th. Corporation. Electrical accessories, service boxes, cables, &c. See "Official Notes" March 27th.

April 18th.—Corporation. Tramcar accessories, brake blocks, overhead line material, &c. See "Official Notices" April 3rd.

April 20th.—Corporation. H.T. feeder cable, transformer and switchgear. See "Official Notices" March 27th.

CLOSED.

Batley.—The Electricity Committee has accepted the tender of the Brush Electrical Engineering Co., for the construction of the pipework, &c., required in connection with the Ljungström turbo-alternator set.

Belgium.—Three concerns submitted tenders last week to the Société Nationale des Chemins de Fer Vicinaux, of Brussels, for the overhead equipment of the extension of the Namur-Citadella-Namur Station light electric railway, the lowest offer being that of the Société A.E.G.-Union Electrique. The tenders ranged from £852 to £1,220.

Blackburn.—The T.C. has accepted tenders of Messrs. Walter Scott, Ltd. (Leeds), for the supply of steel tram rails, and the Electric Construction Co., Ltd. (Wolverhampton), for the supply of a three-wire booster for the electricity works, and for electric motors, for 12 months.

Bolton.—The Corporation contracts for motor starters and direct-current meters below 10 amperes capacity, for the year ending March, 1915, have been placed with the Electrical Apparatus Co., Ltd. Ten top-covers for cars have been ordered from the United Electric Car Co., Ltd.

Bradford.—The Electricity Committee has accepted the offer of Messrs. Ferranti, Ltd., for the supply of E.H.T. switchgear required at Valley Road Works for £685, and that of the British Westinghouse Co. for certain L.T. switchgear for £193, and four 4,000-ampere automatic circuit breakers for £332.

The Committee has also accepted the tender of the Davenport Engineering Co. for the construction of two cooling towers for £4,994, and that of Messrs. Musgrave & Co., Ltd., for the erection of three induced-draught fans, at the Valley Road works for £1,250.

Burton-on-Trent.—The Electricity Committee has accepted the tender of the British Westinghouse, at £4,793, for a turbine and £370 for a switchboard; also that of Messrs. Aiton and Co. for pipework, at £203.

Gloucester.—The T.C. has accepted the tender of Messrs. Cammell, Laird & Co., Ltd., for car wheel tires; and that of the Vacuum Oil Co, Ltd., for light car oil.

L. and N.W. Railway.—Messrs. Balcke & Co., Ltd., have obtained from the London and North-Western Railway Co., a contract for cooling plant for their new power station at Stonebridge Park. It consists of eight natural draught chimney cooling towers of the firm's standard design, having a total capacity of 2,000,000 gallons of water per hour. We are informed that this is the largest cooling tower contract ever placed in this country.

Leyton.—The U.D.C. has accepted the following tenders for repairing the electric light installation at the undermentioned schools during the ensuing 12 months:—

Headland & Headland: Sybourn Street, Norlington Road, Newport Road Canterbury Road, Farmer Road, and St. Joseph's schools.

E. H. Grimshaw & Sons: Davies Lane, Harrow Green and Kirkdale Roe schools.

H. H. Taylor: Cobbold Road and Goodall Road schools.

London.—Islington.—The Lighting Committee has accepted the tender of Messrs. Witting & Partners for two cooling towers, with pipework and valves, the estimate for which was £2,225. The foundation and building work, estimated at £1,250, is to be carried out by the electricity department.

Shoreditch.—The Electricity Committee reports the receipt of the following tenders for the supply and erection of E.H.T. and L.T. switchgear for the electricity works :—

Crompton & Co.	£2,580
Reyrolle & Co., Ltd.	3,055
Johnson & Phillips, Ltd.	2,906
Spagnoletti, Ltd.	2,892
Edison & Swan U.E.L. Co., Ltd.	2,448
Switchgear & Cowans, Ltd.	3,565
B.T.H. Co.	2,761
British Westinghouse E. & M. Co., Ltd. (recommended)	2,350
Siemens Bros. Dynamo Works, Ltd.	1,947
Bertram Thomas	1,949
Ferguson, Pailin & Co.	2,557

Manchester.—The following tenders have been accepted by the Corporation :—

For Electricity Committee :—

Supplies of cable :—B.I. and Helsby Cables, Ltd.; Electrical Engineering and Equipment Co., Ltd.; Johnson & Phillips, and the Western Electric Co., Ltd.

Tramways Committee :—

Tramway rail bonds.—B.I. and Helsby Cables, Ltd.
Trolley wire.—F. Smith & Co., Ltd.
Brackets and tubes for tramway poles.—J. Spencer, Ltd.

For requirements in the tramways department during the year ending March 31st, 1915, the Tramways Committee has accepted the following Tenders :—

Motor and controller spare parts, &c.—British Thomson-Houston Co., Ltd., Rugby.
Brass water caps (B.T.H. equipments).—Gabriel & Co.
Finger brackets, hinge brackets, &c. (B.T.H. equipments), two-way connectors, &c., bell presses, sundry lighting material, &c.—S. Gratrix, junr. & Bro., Ltd.
Fibre strips, &c. (B.T.H. equipments).—Sutcliffe (Crumpsall), Ltd.
Circuit breaker handles (B.T.H. equipments).—D. C. Bate.
Motor and controller spare parts, &c., controllers (complete).—Dick, Kerr and Co., Ltd.
Motor and controller spare parts, traction lightning arresters, 32 car sets magnetic brake equipment, &c.—British Westinghouse Co., Ltd.
Resistances (grid type).—Electro-Mechanical Brake Co., Ltd.
Grids for resistances.—Henry Wallwork & Co., Ltd.
Commutator segments, armature and field coils.—P. R. Jackson & Co., Ltd.
Motor brush-holders, &c.—Kay & Co.
Controller fingers, &c., canopy trolley bases.—Estler Brothers.
Trolley poles.—Brecknell, Munro & Rogers, Ltd.
Incandescent lamps, switches, bells, telephones, &c.—General Electric Co., Ltd.
Incandescent lamps (traction).—Drake & Gorham, Ltd.
Cells, rubber strip, mackintoshes for drivers, &c.—C. Macintosh & Co., Ltd.
Conduit tubing.—Perfecta Seamless Steel Tube, &c., Co.
Amber mica segments, &c.—Meirowsky & Co.
Asbestos, fibre, &c., insulation tape, &c.—L. Andrew & Co.
Celluloid.—British Xylonite Co., Ltd.
Impregnating insulation varnish.—Pinchin, Johnson & Co., Ltd.
Insulating compound.—R. W. Blackwell & Co.
Carbon brushes for traction motors, crucibles, fireclay material, &c.—Morgan Crucible Co., Ltd.
Arc lamp carbons, sundries.—Baxendale & Co., Ltd.
Overhead equipment insulating material, pole switches.—A. Wiseman, Ltd.
Trolley heads.—Equipment and Engineering Co.
Trolley wheel bushes and spindles.—Fleming, Birkby & Goodall, Ltd.
Electrical signal spare parts.—Tramway Supplies, Ltd.
Automatic sanding devices.—M. Cummins.
Tubular sanding devices.—J. Taylor.
Peacock brakes.—Peacock Brake Co.
Automatic lifeguards.—Hudson & Bowring, Ltd.
Folding sideguards.—Philipson & Co.
Power and lighting cables and bell wire.—Connolly Bros., Ltd.
Brass wire, &c., twist drills, and various materials.—Till & Whitehead, Ltd., Manchester.
Steel wire.—F. Smith & Co. (wire manufacturers), Ltd.
Iron and steel wire and cable.—Johnson & Newphew, Ltd.
Lubricating oils, grease, &c.—Isaac Bentley & Co., Ltd.
Varnishes (portion), lapcine.—Robert Ingham, Clark & Co., Ltd.
Enamel.—Blundell, Spence & Co., Ltd.
Fireclay material for pitch boilers, earthenware pipes.—Hall & Rogers.
India-rubber goloshes, gloves, &c.—D. Moseley & Sons, Ltd.
India-rubber tubes for sand gears, &c.—F. Reddaway & Co., Ltd.
Special blocks and wheels for grinding steel rails, emery wheels.—Carborundum Co., Ltd.
Ball races for trolley standards.—W. J. Ritchie & Co., Ltd.
Truck and other springs.—West Bromwich Spring Co., Ltd.
Anti-friction white metal.—Tandem Smelting Co., Ltd.
Tinplates, lead, zinc, spelter, &c.—Rd. Johnson, Clapham & Morris, Ltd.
Car axles and car wheel tires.—Cammell, Laird & Co., Ltd.
Car wheel centres.—Edgar Allen & Co., Ltd.
Gear and pinion wheels.—F. W. Rowlands & Co., Ltd.
Chilled iron brake block castings.—National Rail and Tramway Appliances Co., Ltd., and Interchangeable Brake Block Co., Ltd.
Tramcar meters.—Chamberlain & Hookham, Ltd.
Thermit welding, &c.—Thermit, Ltd., London.

The Corporation tramways department has decided again to use tantalum traction lamps for the ensuing 12 months.

The General Electric Co., Ltd., have received an order from the Corporation for 12-ampere Angold magazine lamps for the lighting of Oxford Street and Peter Street.

Rotherham.—The E.L. Committee has accepted the tender of the British Westinghouse Co. for a turbo-alternator, at £7,925, and one of the British Thomson-Houston Co. for a rotary converter, at £2,755.

South Africa.—Messrs. Hubert Davies & Co., Johannesburg, are the successful tenderers for the new Heilbron electric lighting plant.—*British and South African Export Gazette.*

We understand that the British General Electric Co., Ltd., of Johannesburg, have recently secured the contract for the whole of the plant and equipment for the municipal lighting scheme of Ermelo, in the Transvaal.

Sutton (Surrey).—The U.D.C. has accepted the tender of Messrs. Stuart & Moore, of Ealing, for electric fire alarms, at £349, payable by two annual instalments, and £17 10s. per annum for seven years for maintenance.

Swindon and Highworth.—The B. of G. has accepted the tender of Messrs. J. Lott & Sons, Swindon, for electric cable, flexible and "Phlatta" switches.

Tunbridge Wells.—The Corporation has accepted tenders for the following :—

Piston rings for one 500-kw. Ferranti set.—Allen & Simmonds, Ltd.
Switchgear.—British Thomson-Houston Co.
New atmospheric exhaust pipe and valve.—Babcock & Wilcox, Ltd.
One 7,500-gal. feed pump.—J. P. Hall & Sons, Ltd.
Oil filter in connection with the feed pump.—Glasgow Patents Co., Ltd.
Mechanical stokers to boilers Nos. 3, 4 and 5.—Underfeed Stoker Co., Ltd.

Wimbledon.—The E.L. Committee has accepted the following tenders for annual supplies :—

Extra high-pressure, high-pressure and other cables.—Union Cable Co., Ltd.
Two-core V.I.R. cables.—Western Electric Co., Ltd.
V.I.R. cables, asbestos-braided and cotton-braided cables, workshop and other flexibles.—W. Geipel & Co.
Compounds.—Dussek Bitumen Co.
Tapes, &c.—Siemens Bros. & Co., Ltd.
Service boxes, dividing boxes, &c.—W. Lucy & Co., Ltd.
Sealing ends.—B.I. and Helsby Cables Co., Ltd.
House fuse boxes.—Sykes & Sugden, Ltd.
Frames and Covers.—Callender's Cable Co., Ltd.
Meters.—Ferranti, Ltd.
Accessories.—General Electric Co., Ltd.
Flame arc carbons.—Henrion Carbons.
Destructor tools.—James Harvey.
Lubricating oils.—A. Duckham & Co., Ltd.
Petrol.—Anglo-American Oil Co., Ltd.

Watford.—The E.L. Committee proposes to renew the contract with Henley's Telegraph Works Co., for the supply of cables for a further period of 12 months.

FORTHCOMING EVENTS.

Institution of Electrical Engineers (Newcastle Section).—Monday, April 13th. At 7.30 p.m. At Armstrong College. Address on "Electric Furnaces," by Mr. V. Stobie.

Institution of Engineers and Shipbuilders in Scotland.—Saturday, April 18th. At 7.30 p.m. At Rankine Hall, 39, Elmbank Crescent, Glasgow. Smoking Concert.

Junior Institution of Engineers.—Friday, April 17th. At 8 p.m. At 39, Victoria Street. Paper on "A Few Typical Carburetters, by Mr. R. S. Fox.

Saturday, April 18th. Visit to the Australia House, Kingsway.

NOTES.

Competition for Motor-car Starters.—The Hungarian Automobile Club is arranging a competition for automatic motor-car starters; there will be two classes, one for electrical devices and one for all others. No starter can be entered for the trials unless it is mounted on a car of at least 8-H.P. rating; moreover, no starter is eligible unless it and the car are certified as having come successfully through the Club's severe reliability trials in the Carpathians. Immediately after this year's trials the devices will be examined and judged.

Electrical Ship Propulsion.—News has come to hand that the electrically-propelled United States Government ship *Jupiter* has carried out most successful official trials, on which she maintained a mean sea speed of 15·1 knots for a period specified by the Government of 48 hours, which is ·4 knot above her builders' trial speed: the power developed was 6,940 H.P., with the three-phase twin-screw induction motors running at a mean speed of 115·7 R.P.M. It is reported that the Engineering Department officers of the U.S. Navy are highly pleased with her trial performance, and it has been proved that for her displacement tonnage and speed, she is the most economical ship afloat. In order to clear away any possible excuse for not generally using this type of electrical ship propulsion, and also with a view of getting further data for guidance in the design of future electrically-driven battleships, the American Government have issued orders that as soon as possible she is to leave Mare Island Navy Yard, California, and to proceed over a voyage of no less than 13,000 sea miles, *i.e.*, down the west side of America, nearly to Cape Horn, through the Straits of Magellan, and up the east side to Hampton Roads.

This test is one which is not without risk (even with ordinary vessels) as there are practically no facilities for repairs should anything of a serious nature go wrong with the steam turbine or steering gear, to which all ships travelling in these wild and tempestuous positions, where Atlantic meets Pacific Ocean, are liable. The American engineers, who have carried out most extensive tests, have, however, every confidence in the *Jupiter*, and are now about to put her through what may safely be called the most severe trial for any vessel afloat.

Institution and Lecture Notes.—London Association of Foremen Engineers.—The anniversary banquet of this Association is to be held at Cannon Street Hotel, E.C., on Saturday, May 2nd.

The Institution of Mechanical Engineers will hold its summer meeting in Paris, from July 6th to 10th.

The Iron and Steel Institute has issued a programme of papers and proceedings for the annual meeting, to be held in London, on May 7th and 8th.

Greenock Electrical Society.—The annual meeting took place on the 2nd inst. The secretary, Mr. A. Hurry, read the report of the year's progress; the election of officers for the coming year followed, and the proceedings then took the form of a smoking concert.

A Long Drop.—In a recent issue of a magazine interested in the coal and iron trade there was a note to the effect that an electric hand lamp (Osram), which dropped down the shaft of a colliery 760 ft. deep, was smashed, as far as the case and the accumulator were concerned, but that the metal-filament bulb was found to be intact, and was, in fact, used straight away in conjunction with another accumulator.

Educational Note.—The Council of the Society of Engineers (Incorporated) has passed a resolution that the "abolition of the external degrees in engineering proposed by the Royal Commission on University Education in London would be a grave injustice to many engineering students"; the Council is strongly opposed to the recommendation being carried into effect.

Paraffin Wax for filling Joint Boxes.—At a meeting of the West of Scotland Branch of the Association of Mining Electrical Engineers at Glasgow, replying to the discussion on a paper read by Mr. J. P. C. Kivlen on "The Choice of Mining Electrical Plant," the author said that Mr. Wilson, in the course of his contribution to the discussion, made some sweeping assertions in regard to the use of paraffin wax. While he had only mentioned in his paper that he used it, without in any way advocating its general use, he was now prepared to adduce facts and figures which would be found interesting to those who knew little or nothing of this excellent insulator. Paraffin wax was a pure hydrocarbon, and was the ideal that they all looked for in a transformer or switch-case oil, suitable for the highest voltages. Its insulating properties were much higher than those of any of the bituminous or resinous compounds, and its specific resistance was over twice that of the best rubber. Its useful temperature range was equal to that of vulcanised bitumen, and, strange as it might seem, under ordinary working conditions it was practically fireproof. Mr. Wilson had stated in his criticism that wax was hygroscopic, but he (Mr. Kivlen) was prepared on the authority of a well-known oil chemist, whose life had been spent in the study and production of mineral oils and wax, to assert that such was not the case. In proof of this, he might say that it had been used for many years in the making of condensers. If it had any tendency to retain moisture, it would be useless for this purpose, as the condensers would be incapable of sustaining a charge. It was also used when accurate capacity tests were being made on submarine cables to counteract the effects of atmospheric humidity. There were two reasons why paraffin wax had not come to the front for box filling. The first was entirely obvious to those interested in the sale of compounds, and the second was because it was more expensive. It might not be the ideal thing to use for vulcanised bitumen cables, but it filled all the conditions equally well with box compound. It was clean to use and could be used over again if a box was opened for examination. Finally, he would not suggest the use of wax with paper-insulated cables.

Bioscope Theatre Supply.—The supply of electricity to kinematograph theatres is a matter of considerable importance to station managers; the load is well worth having, and the supply authority is in the fortunate position of having, as a rule, no rival—for the bioscope operator cannot do without electricity.

But there is, nevertheless, an alternative—the private generating plant, which has been brought up to so convenient, efficient and economical a degree of excellence that, where there is space for its accommodation, it seriously threatens the supremacy of the public supply. The only other obstacle, apart from the space question, is the matter of capital cost; but it is reported from Brighton, where the picture theatres complain of the high and unfair charges of the Corporation, that a large firm has offered to provide the machines and accumulators, free of charge, subject to a payment of 2½d. per unit for a period of three years—at the end of which time the picture manager will become owner of the plant without any further payment! The same firm offers to continue to run the plant, after the change of ownership, charging only ¾d. per unit.

We cannot vouch for the truth of this report, but if it is true, and if this arrangement can be carried out on a commercial basis, it seems quite clear that, in the first place, the suppliers who charge 2½d. or more per unit are reaping a fabulous profit; and in the second, that the time is at hand, or has now arrived, when they will either have to be just to their customers, or find themselves supplanted. To persist in classing the load, whether supplied through a motor-generator or not, as a "lighting" one is a mere ostrich-like policy; it is not on all fours with any other load, being indeed part of the professional equipment of the bioscopist, and it is not fair to class it as ordinary lighting. It is to be hoped that station managers will not allow the business to slip out of their hands.

Swiss Electrical Industries.—Some interesting particulars regarding the growth of the Swiss electrochemical and metallurgical industries in 1912 are furnished by a report of the Federal Customs Departments. The manufacture of carbide of calcium, including that transformed into cyanamide, amounted in the year to 40,000 tons. Its selling price, through the action of the International Syndicate, remained normal, and active steps were taken to enlarge the openings for its consumption. In particular its employment has been extended in connection with autogenous soldering and in the manufacture of cyanamide. Some extension of its use has also taken place for portable lighting requirements, and in certain new applications of acetylene in the manufacture of chemical products. The world's consumption of carbide is estimated at 300,000 tons. The manufacture of carborundum has likewise undergone extension, and the Swiss production is estimated at 3,400 tons. The manufacture of another abrasive substance has also been started in Valais, called "abrasite," the output of which is between 1,000 and 1,500 tons a year. It is an artificial carborundum with an alumina base. The advance in price of aluminium, foretold in the previous year, was realised, and the Syndicate of Manufacturers again fixed the price at 2 fr. The output of the Aluminium-Industrie Aktien-Gesellschaft, of Neuhausen, was considerably increased by the operations of its works at Chippis, which was started in 1911. The consumption of aluminium has steadily advanced, and new applications for it are constantly being found. For example, it has been found possible to make an aluminium paper, which has obtained a great vogue as wrapping for chocolate. For the manufacture of this aluminium paper, 42 m.² of which are made from 1 kg. of metal, some 1,200 tons were employed during the year, and it is very probable that this quantity will be largely exceeded in coming years. The export figures of articles coming under Class XIG of the Customs tariff, comprising pure aluminium, as ingots, bars, sheet, pipe, aluminium alloy wire, industrial and other manufactured articles, more than doubled those of the previous year. It reached the figure of 85,710 metric quintals, of a value of 13,892,541 fr.; whereas the corresponding figures in 1911 were 38,032 metric quintals and 6,752,035 fr. Of iron alloys, ferro-silicon, which is now being made in three localities in Switzerland—at Martigny, Viège (Lonza) and Bodio—appears to have revived, and the Swiss outturn should exceed that of the previous year; it amounted to between 7,000 and 8,000 tons. The total consumption of ferro-silicon may be estimated at between 35,000 and 40,000 tons. Ferro-chrome continues to be manufactured, as also ferro-silicon, at Martigny (Météor) and at Bodio, also ferro-tungsten at Chèvres; the output of the last-named alloy is estimated at about 300 tons; this is an increase on that of the preceding year.

The London Electrical Dispute.—The strike of electrical wiremen continues in London. From the statements appearing in the newspapers from day to day it is not possible to gather which, if either, side is winning. The Trade Union claims that many firms have agreed to its demands, but Mr. Tate says that not one member of the London Electrical Masters' Association has so agreed. It is stated that a letter was sent by the Masters to the Union inviting the officials of the latter to meet the Association, with authority to agree to Rule 1, which prohibits exception being taken to the employment of non-Union men. The E.T.U. organiser says that the Union has everywhere steadfastly refused to accept a disability clause, and it cannot accept it in London because it is affiliated to the Building Industries Federation, which is continuing its struggle on this very point. "For us to accept it would probably seriously prejudice their position." The inconvenience to members of the Masters' Association is said to be very slight. The secretary's estimate the other day was that not more than 250 men were on strike. A financial daily says that on the 6th inst. 500 were out, and that "50 master electricians, including some of the best firms in London," had given way and agreed to the men's demands. There appear to have been conferences between the Electrical Trade Union and the Newspaper Owners' Association respecting the pay and conditions of Union electricians employed in newspaper offices, and there has been a slight trouble at Marylebone, now satisfactorily settled, consequent upon an employé of the Corporation electric supply department being sent to a job described as "black." The men at the Office of Works are out.

The Siemens Smoking Concert.—On Monday the directors and staffs of Messrs. Siemens Bros. & Co., Ltd., and Messrs. Siemens Bros. Dynamo Works, Ltd., held a smoking concert in the King's Hall of the Holborn Restaurant. Mr. Alexander Siemens presided, and the hall was comfortably filled with the members of the staffs and their numerous guests. The programme, the cover of which was embellished with a special design, suggestive of the cordial relations prevailing between the various branches of the Siemens companies throughout the United Kingdom, was an exceptionally good one, and credit is due to Mr. George Lakeman, under whose direction it was performed; it included such names as Miss Violet Essex, Miss Ruby Wilson, Messrs. Joseph Cheetham, Joseph Bull, Dutch Daly and other eminent artistes, whose efforts were cordially appreciated by the audience. Mr. Harry Gooding's Imperial Orchestra played selections during the reception and interval. Altogether the organisers are to be congratulated upon a function marked with every feature of success and enjoyment.

Electrified Horses.—According to the *Daily Express*, Mr. C. J. Palmer, a London electrical specialist, proposes to apply electrical treatment to stimulate the growth of racehorses.

Photography an Electrical Action.—At the meeting of the Royal Photographic Society on March 17th, Mr. H. Stanley Allen, D.Sc., delivered a lecture on the electronic theory of the latent image on the photographic plate. In his opinion, the fundamental change in a plate on exposure to light was a physical one. A chemical alteration in the nature of actual decomposition might follow it, but there must be first a movement or commotion within the molecule of the emulsion. This physical change, he thought, ought to be considered from the point of view of the two great modern advances in theoretical physics, the electromagnetic theory of light on the one hand, and, on the other, the theory that negative electricity consisted of discrete particles or electrical atoms known as electrons. The result of putting these two theories in conjunction, was to suggest that light could only act up on matter by setting in vibration an electron or some electrified body of atomic dimensions. If the vibrations were extremely rapid, as in the case of ultra-violet light, they would act on the electrons; and if slower, as in the case of the red end of the spectrum, they would act on atoms or groups of atoms. What was known as the photo-electric effect was the liberation of electrons from ordinary matter when light, especially of short wave-length, fell upon it. He showed by experiment how a polished metal plate easily lost a negative charge of electricity when illuminated by ultra-violet light, although it retained a positive charge. Dr. Allen regarded it as quite likely that ordinary photographic action was the result of ionisation, or the splitting up of the atom or molecule into parts which were oppositely electrified. The result of waves of light falling upon a photographic film was to liberate electrons from the haloid grain in that film, the electrons moving with a velocity which depended upon the stimulus applied, being most pronounced under ultra-violet impingement. Passing away from the grain, these electrons became attached to the neighbouring molecules of the gel, and the developer, acting on this ionised arrangement, produced the developed image. The phenomenon known as photographic reversal, Dr. Allen explained by supposing that the emission of electrons under a great stimulus of light was so considerable as to cause a heavy positive charge on the parent grain, and a heavy negative charge on the accumulation of electrons around it, leading up to such a point as to bring about spontaneous neutralisation, the grain of haloid reverting to its original condition. This view of reversal was challenged in the course of the subsequent discussion, but Dr. Allen maintained that the analogy of the Leyden jar was a good one. If one took a Leyden jar, connected it to a Wimshurst machine, and went on charging up, a stage would be reached at which the equilibrium broke down. In the same manner, on continuing to expose a photographic film to light, the electrical field would be such that a stage would be reached at which neutralisation took place spontaneously.

Electric Lighting of Motor-'Buses.—It is generally admitted that the National steam'buses are amongst the best lighted of the motor vehicles in service in London at the present time. In the course of a recent paper Mr. Thomas Clarkson gave some particulars of the electric lighting equipment now installed, which comprises a dynamo directly coupled to a small steam engine, this replacing the battery-dynamo lighting system, which was used for several years. A steam pressure of about 70 lb. per sq. in. is found ample; the engine and dynamo run at 950 R.P.M., and the dynamo has an output of 14 amperes at 12 volts. Metallic filament lamps are used. This equipment is the most satisfactory of any tried by the author, who stated that it is cheaper both to install and to maintain, and there is a saving of about 100 lb. in weight as compared with the battery-dynamo system. The effect of fluctuations in boiler pressure (which are inevitable in consequence of the variable demands for power, especially in congested traffic) is avoided by fitting a reducing valve to the lighting engine.

Electricity Supply Authorities and their Employés.—Mr. H. H. Harper, city electrical engineer of Melbourne, writes under date February 27th:—"In your issue of January 9th, page 41, reference is made to efforts which are being made by two associated electric power and supply companies in North Metropolitan districts to secure the insertion in their Bill of clauses prohibiting strikes of their employés. I enclose herewith copy of Sections in the Victorian Employers' and Employés' Act dealing with this question, which may be of interest to you." We print the Sections below:—

EMPLOYERS' AND EMPLOYES' ACT, NO. 1,219, DATED DECEMBER, 1891.

Sec. 3.—"Employé" shall not include a domestic servant, but save as aforesaid shall mean any person who, being a labourer, shepherd, stockman, servant in husbandry, journeyman, artificer, handicraftsman, miner or otherwise engaged in manual labour, whether under the age of 21 years or above that age, has entered into or works under a contract with an employer, whether the contract be made before or after the passing of this Act, be express or implied, oral or in writing, and be a contract of service, or a contract personally to execute any work or labour.

Sec. 17.—Where a person employed by a municipal authority or by any company or contractor upon whom is imposed by Act of Parliament the duty, or who have otherwise assumed the duty of removing, dealing with or treating the sewage of any city, town, borough or shire, or of supplying any city, town, borough or shire, or any part thereof with gas or electric light or any other species of light or water, wilfully and maliciously breaks a contract with that authority, or company or contractor, knowing or having reasonable cause to believe that the probable consequences of his so doing, either alone or in combination with others, will be to deprive the inhabitants of that city, town, borough or shire wholly or to a great extent of their supply of gas or electric light or other species of light, or water, or to interfere with the sewage thereof, he shall on conviction thereof by a Court of Petty Sessions or on indictment or presentment as hereinafter mentioned, be liable either to pay a penalty not exceeding £20, or to be imprisoned for a term not exceeding three months, with or without hard labour.

Every such municipal authority, company, or contractor, as is mentioned in this section shall cause to be posted up at the gas-works, electric lighting works, waterworks, or other works, as the case may be, belonging to such authority, or company, or contractor, a printed copy of this section in some conspicuous place where the same may be conveniently read by the persons employed, and as often as such copy becomes defaced, obliterated, or destroyed, shall cause it to be renewed with all reasonable despatch. If any municipal authority, company, or contractor, make default in complying with the provisions of this section in relation to such notice as aforesaid, they or he shall incur on summary conviction by a court of petty sessions, a penalty not exceeding £5 for every day during which such default continues, and every person who unlawfully injures, defaces, or covers up any notice so posted up as aforesaid in pursuance of this part of this Act, shall be liable, on summary conviction, to a penalty not exceeding 40s.

The Storage of Celluloid.—Three public authorities have introduced Bills into Parliament affecting the storage of celluloid and articles into which celluloid enters—London County Council (General Powers) Bill, City of London (Various Powers) Bill, and Glasgow Corporation (Celluloid) Bill. An appeal for funds has been issued, together with a memorandum by Mr. James D. Kiley (chairman of the Fancy Goods Section of the London Chamber of Commerce) in connection with opposition which it is intended to offer.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—Recommendations to come before the Warrington Town Council are that the salary of MR. F. V. L. MATHIAS, chief electrical engineer and tramway engineer, shall be increased from £425 to £450, with two annual increments of £25 each; and that the salary of MR. JOHN TELFER, tramways manager, shall be increased from £250 to £276.

MR. GEO. BROADHURST, assistant electrical engineer at Worthing, has resigned, he having been appointed electrical engineer to the Basingstoke Corporation.

The Swansea Electricity Committee received 64 applications for the position of charge engineer, and gave the chairman, vice-chairman, and chief engineer, power to make the appointment.

Tramway Officials.—MR. ALBERT E. WRAY, assistant manager of the South Metropolitan Tramways Co., was, on leaving to take up a new appointment, presented with a clock and an illuminated address. The proceedings were held in the depôt at Mitcham Road, Croydon, and Mr. A. V. Mason, the manager of the company, made the presentation. Mr. Wray has been with the company since 1909. He has now been appointed manager and engineer of the Gravesend and Northfleet Tramways Co. and the North Kent Motor-Omnibus generating services.

General.—The Highways Committee of the L.C.C. recommends that SIR ALEXANDER KENNEDY be appointed consulting engineer to advise and report as to the arrangements from the point of steam consumption in connection with the extension of the Greenwich electricity station and generally on the station extensions, and to advise the chief officer of tramways generally on questions connected with such extensions and to afford the Council whatever consultative assistance may be required. Messrs. Kennedy and Donkin are to be appointed engineers for specifying and superintending such new plant or work as the Council may place in their hands at a retaining fee of £500 to cover all references, reports and consultations in connection with the tramways undertaking; 5 per cent. commission on all certificates for plant up to £50,000 a year and 4 per cent. on expenditure over this amount; a commission of 3 per cent. only to be paid on the new constructive work in connection with the second stage of the extension at the Greenwich station.

MR. N. G. BARRACLOUGH, electrical engineer to the Workington Iron and Steel Co., Ltd., Workington, is going to Canada and the Eastern States of America, in May, for a short vacation, and he intends visiting large electrical works and iron and steel works where electrical power is extensively used.

We understand that MR. G. R. DRUMMOND, M.I.E.E., M.I.M.E., after nine years of continuous service as electrical and mechanical engineer to the Bikanir Government, India, severed his connection with that State early in March, 1913, and, after a short stay in Jodhpur, for which State he was consulting engineer, sailed for Australia with his wife and family for a holiday and for seeing the various electrical undertakings in the several States. Mr. Drummond returned to India in November, 1913, to resume his duties, and proceeded to Lahore to reconstruct

the Lahore Electric Supply Co.'s undertaking. In January, 1914, the Jodhpur Durbar decided to accept the electrical power scheme put forward, and offered the post of electrical and mechanical engineer to their State to Mr. Drummond, which offer was accepted, and in March, 1914, Mr. Drummond took up this appointment, and commenced work on the scheme. All the plant is on order from England, and it is hoped to commence the supply towards the latter part of 1914.

Mr. H. D. Johnston, late of the Canadian British Insulated Co., Ltd., Montreal, has joined the staff of the Eugene Phillips Electrical Works.

Dr. R. Pohl, M.I.E.E., of Bradford, has been appointed by the Bradford Technical Education Sub-Committee as External Examiner in Electrical Engineering for the final examinations for the Technical College diplomas and for the Technological Exhibitions for the present year.

A marriage was to take place on Wednesday, April 8th, between Mr. William H. Gatley, A.M.I.E.E., electrical engineer and contractor, Todmorden, and Miss Grace Crabtree, eldest daughter of Mr. Barker Crabtree, cotton manufacturer, Cross Lee, Todmorden, Yorks.

Mr. Bentham, electrical engineer of the Thryberg Hall and Warren Vale Collieries, Kilnhurst, who has occupied his position for the past 30 years, has been presented with a gold lever watch by the officials and workmen employed at the collieries. The presentation took place at the Church Hall, Kilnhurst, at a concert, presided over by Mr. H. S. Witty, the manager of the collieries. During the evening Mrs. Bentham was presented with a pendant.

Mr. F. Heppenstall, A.M.I.E.E., has resigned the position of manager of the switchgear and transformer department of Messrs. Johnson & Phillips, Ltd., Charlton, S.E., to take up an appointment with the General Electric Co., Ltd., 67, Queen Victoria Street, E.C., where he will devote his particular attention to matters in connection with wires and cables.

Mr. A. E. C. Burgess has joined Mr. A. C. F. Webb, of Sydney, as partner. The name of the firm is A. C. F. Webb & Burgess, and their address, 1,105, Culwulla Chambers, Castlereagh Street, Sydney. Mr. Burgess is visiting England with the object of seeing the latest developments, and his address will be, until July, c/o London Bank of Australia, 71, Old Broad Street, London, E.C.

Obituary.—We much regret to record the death of Mr. H. Hewson Brown, the well-known character impersonator. He was a member of the Electro-Harmonic Society, and should have appeared in a sketch "Impressions from Life," at its last smoking concert, but, as the musical director announced, he was then suffering from pneumonia, although two days before he was apparently in his usual health. He died on the following Tuesday, March 24th, at the early age of 33, and our estimable contemporary, the *Referee*, states that his widow and three young children are left quite unprovided for. A fund for their benefit has been opened, and donations should be sent to Mr. Harry Hall, 207, Oxford Street, W. A Bohemian Concert in aid of the fund will be given at King's Hall, Holborn Restaurant, on May 5th, and tickets, price 2s. and 1s., can be obtained from Mr. Hall. Mr. H. Hewson Brown was, we understand, formerly with the Sun Electrical Co., and later he was a director and manager of the Hewson Manufacturing Co., Ltd., electric sign makers, of Wardour Street, W., giving up his connection with that firm only in February last. This sad end to a promising career is one that we think may appeal to the Electrical Trades Benevolent Institution, and members of the Electro-Harmonic Society may also wish to show their appreciation of Mr. Brown's annual appearances by supporting the fund above mentioned.

NEW COMPANIES REGISTERED.

Henry Pooley & Son, Ltd. (134,898).—Registered March 27th, by Waterlow Bros. & Layton, Ltd., Birchin Lane, E.C. Capital, £150,000 in £1 shares. Objects: To take over the business, assets and liabilities of a company with a similar title, in liquidation, to adopt an agreement with the said old company, A. J. Giles and W. and T. Avery, Ltd., and to carry on the business of manufacturers of and dealers in weights, measures, scales, balances, weigh-bridges and weighing and other machines and appliances of all kinds for or used in connection with weighing, measuring or estimating length, area, capacity, number or quantity of articles, materials, substances, force or energy, including automatic machines and appliances, electricians, mechanical, electric and general engineers and contractors, founders, machinists, &c. The signatories (with one share each) are:—W. Chamberlain, Pendock Grove, Cobham, manufacturer; G. C. Vyle, Soho Foundry, Birmingham, manufacturer. Private company. The first directors (to number not less than two or more than 11) are C. H. Bartlett, A. H. Gibson, Sir James F. Fiannery, Bt. (chairman), L. Jacobs, C. E. Martineau, H. Pooley, J. S. Pooley, W. W. Wiggin and G. C. Vyle. Messrs. W. and T. Avery, Ltd., may, while holding three-fourths of the paid-up share capital, appoint directors. Solicitors: Pinsent & Co., 6, Bennetts Hill, Birmingham.

Argentine Electricity Co., Ltd. (134,883).—This company was registered on March 27th, with a capital of £45,000 in £1 shares, to generate, produce, distribute and deal with electricity for lighting, heating, telegraphy, telephony, or otherwise. The subscribers (with one share each) are:—F. J. Moss, 59, Whippendell Road, Watford, clerk; J. C. Fennings, 94, Endsleigh Gardens, Ilford, clerk; R. W. Ames, 93, Green Street, Bethnal Green, N.E., clerk; R. Walker, Mill Park Lodge, Hornchurch, solicitor; J. H. Collins, 131, Elthorne Avenue, Hanwell, W., clerk; H. W. Newton, 37, Queen Victoria Street, E.C., solicitor; E. Boys, 37, Queen Victoria Street, E.C., clerk. Minimum cash subscription, £1,000. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first; qualification (except first directors), £100; remuneration as fixed by the company. Registered office, Capel House, 62, New Broad Street, E.C.

Marbro, Ltd. (134,921).—This company was registered on March 28th, with a capital of £3,000 in £1 shares (1,500 cum. part. pref.) to carry on the business of manufacturers of, and dealers in, electrical goods, apparatus and accessories of all kinds, &c. The subscribers (with one share each) are:—A. H. Simpson, 16, Hunsdon Road, New Cross, S.E., clerk; T. J. Grady, 40, Rainbow Street, Camberwell, S.E., clerk. Private company. The number of directors is not to be more than five; the first are not named; remuneration, one guinea each per board meeting attended and 2½ per cent. of the surplus profits in excess of 6 per cent. upon the cum. participating pref., and 10 per cent. on the ord. Registered office, 22, Belsham Street, Morning Lane, Hackney, N.E.

Tucuman Tramways, Light and Power Co., Ltd. (134,880).—Registered March 26th by Ashurst, Morris, Crisp & Co., 17, Throgmorton Avenue, E.C. Capital, £611,000 in £1 shares. Objects: To generate, distribute, supply and employ electricity, whether for light, heat, power or other purpose, to acquire and carry out contracts, concessions or grants for the construction, maintenance, repair, operation or control of railways, tramways and other roads or ways, or electric lighting and other works, to contract for the lighting of any public or private places by electricity or otherwise, &c., and to adopt an agreement with the Cordoba Central Railway Co., Ltd. The signatories (with one share each) are:—G. W. Hoghton, 3, St. Helens Place, E.C., company director; A. M. Smith, 3, St. Helens Place, E.C., company director; A. H. A. Knox Little, 9, Rue Louis le Grand, Paris, civil engineer; R. A. Roberts, 283, Lewisham High Road, S.E., incorporated accountant; G. Tyrel, 3, St. Helens Place, E.C., solicitor; H. F. Plant, 3, Park Road, Forest Hill, S.E., clerk; W. E. Rosser, 191, Sebert Road, Forest Gate, Essex, clerk. Minimum cash subscription seven shares. The first directors (to be not less than three or more than seven) are to be appointed by the signatories. One of such first directors shall be a person nominated by the sellers, under an agreement of February 28th, 1914, referred to in the agreement above mentioned. Qualification, £100; remuneration, £700 per annum, divisible. The directors' borrowing powers are restricted to twice the amount of the issued capital for the time being. No notice of situation of registered office has been filed.

Mander Utility Co., Ltd. (134,811).—This company was registered on March 24th, with a capital of £6,300 in 6,000 8 per cent. cumulative preference shares of £1 each, and 6,000 ordinary shares of 1s. each, to carry on the business of manufacturers and agents and factors for the sale of electrical apparatus and appliances, telephones, telephone and bell wire, flex electric bells, dry cell batteries, motor-car lamps and novelties, &c., and to adopt an agreement with J. W. Mander. The subscribers are:—J. W. Mander, 30, Greenhill Road, Harrow-on-the-Hill, manufacturers' agent, 100 cum. pref. shares; H. Pawlik, 103, Edith Road, West Kensington, manufacturers' agent, 100 cum. pref. shares; E. E. Haynes, Compton House, Hounslow, secretary, 1 cum. pref. share; A. M. Junkermann, 103, Edith Road, West Kensington, manager, 1 cum. pref. share; E. N. Fellowes, 29, Warwick Square, S.W., solicitor, 50 cum. pref. shares; C. H. Marks, 49, Calshorpe Street, W.C., clerk, 1 cum. pref. share; H. W. Palmer, 17, Villiers Road, Bushey, Herts., cashier, 1 cum. pref. share. Minimum cash subscription, 20 per cent. of the shares offered to the public. The number of directors is not to be less than two or more than five; the first are J. W. Mander, H. Pawlik, E. N. Fellowes, C. Drummond-Wolfe and S. G. Fraser; P. S. Tompkins is first secretary; qualification, 100 shares; remuneration (except managing directors or manager), £50 per annum (chairman £100). Registered office, 1, Great Winchester Street, E.C.

Cleartone Antiseptic Telephone Drum, Ltd. (134,862).—This company was registered on March 26th, with a capital of £1,000 in £1 shares, to carry on the business indicated by the title and that of manufacturers of and dealers in paper appliances, &c., and to adopt an agreement with R. C. Belt, R. F. Popham and H. Davidson. The subscribers (with one share each) are:—H. Davidson, 13, Chepstow Mansions, Chepstow Place, W.C., company director; R. F. Popham, 16, Kensington Gardens Square, W., gentleman. Private company. The number of directors is not to be less than two or more than five; the first are R. C. Belt, H. Davidson and R. F. Popham. Registered office, 59-61, New Oxford Street, W.C.

H. F. Foster & Co., Ltd. (134,981).—This company was registered on March 27th, with a capital of £7,000 in £1 shares, to carry on the business of specialists in the lighting of motor-cars, railway carriages and vehicles, manufacturers of, and dealers in, dynamos, electric plant, machinery and fittings, &c. The subscribers are:—A. H. Benson, 62, Ludgate Hill, E.C., company director, 2,000 shares; A. W. S. Pocklington, 47, York Street, Westminster, S.W., 100 shares. Private company. The number of directors is not to be less than two or more than five; the first are A. H. Benson, Ankerwycke, Wraysbury, Bucks.; A. W. S. Pocklington, Ballard's Garden, Ewell, Surrey; and H. F. Foster, Stanley House, West Street, Epsom; qualification, £200; remuneration of A. W. S. Pocklington, as managing director, £500 per annum; of others, as fixed by the company. Registered office, Ashley Works, South Street, Epsom.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

City of Buenos Ayres Tramways Co. (1904), Ltd. (82,214).—Capital, £1,240,000 in £5 shares. Return dated March 2nd, 1914. All shares taken up. £1,240,000 paid. Mortgages and charges: £174,000.

Newcastle and District Electric Lighting Co., Ltd. (28,022).—Capital, £300,000 in £10 shares. Return dated March 13th, 1914. All shares taken up. £10 per share called up. £297,500 paid, leaving £2,500 in arrears. Mortgages and charges: £298,840.

Lamp Manufacturing Co., Ltd. (76,151).—Capital, £10,000 in £1 shares; return dated February 3rd, 1914; 5,400 shares taken up; £5,400 paid. Mortgages and charges: £2,500 debs.

Morley Electrical Engineering Co., Ltd.—Capital, £5,000 in £1 shares: return dated February 16th, 1914; 1,524 shares taken up; £504 paid; £1,020 considered as paid. Mortgages and charges, £3,000.

Autolectric Transmission, Ltd.—Debenture dated March 13th, 1914, to secure £250, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: O. A. Knight, 37, York Road, Hove, Brighton.

Broom & Wade, Ltd.—Particulars of £3,930 second debentures, created March 4th, 1914, and secured by trust deed of even date, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908: the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital and freehold hereditaments at Lindsay Avenue, West Wycombe, Bucks., subject to prior mortgages for £1,500 and £4,000. Trustees: J. C. Peache and G. B. Lawrence.

C. F. Casella & Co., Ltd.—Mortgage dated March 14th, 1914, to secure £600, charged on 16, Gurney Street, Walworth, with yard, stables, cartsheds and workshops. Holder: Miss V. Abraham, Coleraine, County Derry, Ireland.

Church Stretton Electric Supply Co., Ltd.—A memorandum of satisfaction in full (*a*) on March 4th, 1914, of charges bearing various dates from March 17th, 1909, to July 24th, 1912, securing in the aggregate £1,075; and (*b*) on February 18th, 1914, of trust deed dated March 19th, 1904, securing £5,000, has been filed.

CITY NOTES.

Urban Electric Supply Co., Ltd.

The annual meeting was held on April 1st at Salisbury House, London Wall, E.C., Mr. H. B. Grotrian presiding, in the absence of the chairman of the company, Mr. P. D. Tuckett, who had had to leave for the United States on business.

The Chairman in proposing the adoption of the report (see Elec. Rev., page 547), remarked that before leaving this country Mr. Tuckett asked him (Mr. Grotrian) to tell the shareholders that he left without anxiety as far as the company was concerned, as he considered that its affairs were in a satisfactory condition. Dealing with the accounts and taking the profit and loss account first there was an increase of £7,435 in the item of profits earned at various works, being an increase of 13 per cent. which was the same rate of increase as obtained last year, so they would see that the company showed steady progress. Coal had again, unfortunately, cost them more—an increase of £1,587 on top of an increase of £4,427 last year, due entirely to the higher price of coal. The amount carried down to net profit was £61,684, as against £54,265 a year ago. On the debit side of the profit and loss account, interest to contractors showed an increase of £1,557, and interest on debenture stock an increase of £1,139. The amount set aside for redemption of debenture stock was increased by £781, making a total increase in charges of £3,477, leaving, with £996 brought forward, a net disposable balance of £23,021. They proposed to apply that balance as follows: reserve for depreciation, £12,000; dividend of 4 per cent. for the year on the preference shares, £10,000; leaving a balance of £1,021 to be carried forward. The 1 per cent. balance of dividend on the preference shares would be paid by funded dividend certificate as last year. If the company made the same progress in the present year as it had in the past year they would, of course, be able next year to pay the full dividend on the preference shares in cash. The capital expenditure in the year was £76,260, an increase over last year of £21,576. This was largely accounted for by the Cornwall Power Co.'s increased expenditure of £18,583 compared with last year. Debenture stock issued during the year amounted to £34,918, from which had to be deducted £6,093 purchased for redemption under the terms of the sinking fund. Two items which appeared in last year's balance sheet, namely, preliminary expenses, £2,081, and discount and stamp duty on debenture stock issued, £28,881, were no longer shown, as, together with discount on debenture stock issued during the year, £5,221, they had been written off against capital reserve fund, and he thought they would agree that that was an improvement to the balance sheet, those items being assets of an undesirable nature. To redemption reserve they had added this year £6,039 against last year's £5,875, and they now recommended that a further £12,000 be set aside for reserve for depreciation, making a total reserve of £62,339, which he hoped they would consider satisfactory. Proceeding to deal with the results shown by the various companies in which the company was interested the chairman said that the lamp connections had again been large, showing an addition of the equivalent of 82,824 33-watt lamps, of which addition 36 per cent. was for lighting and 64 for power. A good feature of this connection was that a larger proportion was for lighting than last year. The additions made in the year increased the previous total connections for lighting by 8 per cent. and for power by 17 per cent. The output in units for the past year showed an increase of 5,344,495, from 16,690,488 to 22,034,983, Cornwall, as last year, being principally responsible for the increase. Regarding the profits realised in individual undertakings good results had been shown at Twickenham and Stamford, while Newton Abbot, Caterham and Berwick had also made fair progress. Hawick showed a small increase, and would have done better but for the depression in the textile trade. The small reduction shown at Weybridge was accounted for by the decrease in profit on their wiring business; but, there the effect of the metal filament lamp was being specially felt, whilst at Dartmouth the decrease was due to a similar cause, the consumption by the Naval College being again largely reduced. The other towns—Godalming, Grantham and Glossop—had all suffered from the effects of dearer coal, which largely accounted for the want of progress. The Cornwall Electric Power Co. again showed a greatly increased profit—£11,775, which was £5,490 more than last year. The profit this year was 7 per cent. on the capital spent, which he thought they would consider a satisfactory result for a power company only in its third year of working. The difficulty in Cornwall last year was not so much in obtaining increased profitable business as in being able to obtain from the makers the large units of machinery and plant requisite to cope with that increased business. That difficulty had been overcome and they now had installed at Hayle 9,000-kw. of plant, which was ample for present requirements. The business was, however, growing rapidly and contracts had been arranged which would largely increase the demand upon the station. Of course, all this involved somewhat heavy capital expenditure, but the directors had the matter under consideration and there should be no difficulty in raising funds for the Cornwall undertaking so long as such profitable results could be shown. On the whole, they might take it that the business was making steady progress. There was a prospect of the cost of coal being reduced, and should this be realised a substantial improvement might be looked for in all their stations.

Mr. Edmund Charrington seconded the motion.

In reply to questions the Chairman said the board had gone into the question of capital expenditure and they estimated that they would have to spend about £35,000 on that account this year. They did not take any business on now unless they could see a very substantial return on it, and if they had such business offered them it would be foolish of them not to take it. Therefore they could not altogether stop capital outlay. The amount of the redemption under the sinking fund was one per cent. cumulative, which this year would amount to about £7,000. The debentures for the purpose were purchased in the open market. Regarding their coal, they always impressed upon the engineers at their various stations the necessity of maintaining at least a six weeks' supply.

The report was adopted.

Chilian Electric Tramway and Light Co., Ltd.

An extraordinary general meeting of the shareholders of the above company was held on April 2nd at the office, London Wall Buildings, E.C., Mr. L. Breitmeyer presiding.

The Chairman said the object of the meeting was to consider a resolution for increasing the borrowing powers of the directors. The present borrowing powers were limited to the extent of the company's capital, which was £1,150,000, and as considerable additional capital expenditure had been incurred and more might be necessary, they thought it necessary to ask for additional powers to meet any contingency that might arise. He therefore moved that the directors be authorised to borrow, raise or secure further moneys but so that the amount for the time being owing in respects of moneys borrowed, raised or secured, shall not exceed £2,000,000.

Mr. Hector de Backer seconded the resolution, which was carried without discussion.

Tynemouth and District Electric Traction Co., Ltd.

The annual meeting was held on Friday last at Electrical Federation Offices, Kingsway, Mr. H. S. Day, presiding.

In proposing the adoption of the report (see Elec. Rev., page 589), the Chairman said that the past year had shown an improvement upon 1912 which had enabled them to somewhat strengthen their reserves, to pay an additional one per cent. dividend and to carry forward a slightly increased amount as compared with the previous year. It was satisfactory to know that the receipts to date were up to expectations and if only they had a good summer their prospects were very encouraging.

Mr. Geo. J. Somerville seconded the motion and the report was adopted without discussion.

The French Osram Co.—It is proposed to increase the share capital of the Société Anonyme La Lampe Osram by the issue of £140,000 in ordinary shares and £120,000 in preference shares, the latter to be paid to the extent of 25 per cent. The additional capital is required for the purpose of extending the scope of the company and the acquisition of the Paris firm of Rich. Heller, who manufacture electrical specialities, and who will receive £20,000 in ordinary shares of the French Osram company as the purchase price.

Continental.—Germany.—The Deutsche Kabelwerk Gesellschaft, of Lichtenberg, Berlin, reports a net profit of £34,685 for the last financial year, as compared with only £31,017 in 1912. Of this sum £4,449 is being devoted to a special reserve, £4,527 to bonuses, £21,000 distributed in the form of an 8 per cent. dividend to the shareholders, leaving £4,709 to be carried forward.

Great Northern Telegraph Co., Ltd., of Denmark.—At the general meeting which will be held at Copenhagen on April 25th, the board will propose to pay a total dividend and bonus of 20 per cent. for the year 1913, including the 5 per cent. already paid, and to transfer the usual amounts to the reserve and pension funds.

County of London Electric Supply Co., Ltd.—The subscription list in respect of the new issue of 10,000 preference and 6,000 ordinary shares was closed on the 31st ult., and the issue was largely over-subscribed. The allotment letters and letters of regret were posted on Saturday, 4th inst.

La Plata Electric Tramways Co., Ltd.—The directors recommend a balance dividend on the preference shares of £6,000, covering the period from March 1st to August 31st, 1912, placing £1,000 to reserve, and carrying £330 forward.

Callender's Share and Investment Trust, Ltd.—It is announced in the Press that an interim dividend at the rate of 5 per cent. per annum is to be paid for the six months ended February 28th.

Bell's United Asbestos Co., Ltd.—The total distribution on the ordinary shares for 1913 is 12½ per cent., £5,000 is placed to general reserve fund, and £12,693 is carried forward.

Lima Light, Power and Tramways Co.—A dividend of 1 per cent. for the final quarter of the year is declared.

Lymington (Hants.) Electric Light and Power Co., Ltd.

At the annual meeting the Chairman (Mr. Keppel Pulteney) said he was glad that their record was much of the same satisfactory character as hitherto. The number of consumers had increased. The output of units generated showed a substantial increase, the sale of current having gone up by £145. The chief item of expense was coal and other fuel (£422), which showed the large increase of £90, but there had been a larger output. The Chairman complimented Mr. Holman (the resident engineer) and Mr. Jones (the secretary) on their working of the company. In concluding, the Chairman alluded to the large amount to be carried forward, explaining that with an increased business the directors might think it advisable to provide an additional engine and dynamo.

Prospectuses.—*General Electric Co., Ltd.*—The subscription list opened on Monday, and was to close on Tuesday, in an issue at par of 30,000 6 per cent. cumulative preference shares of £10 each, and 10,000 ordinary shares of £10 each. The objects of the issue are stated as follows:—

"(*a*) The erection of a building in Kingsway to accommodate the whole of the company's office and warehouse staff in London, for which purpose a site containing 25,000 superficial ft. has been acquired. The building, with its proper equipment, is expected to cost about £150,000.

"(*b*) The extension of the Witton Engineering Works, Birmingham.

"(*c*) The subscripton of £100,000 in shares (being a moiety of the capital) of Pirelli-General Cable Works, Ltd., which has been formed to erect and carry on works at Southampton for the manufacture of cables for power, lighting, and other purposes.

"(*d*) The extension of the company's trade at home and abroad, and in particular through the medium of its subsidiary and associated companies.

"The continued growth of the business has made ever-increasing demands on the premises of the company for the housing of the necessarily larger number of employés, and for stocking the greater variety of goods which have to be stored for meeting the requirements of customers. The centralisation of the London business under one roof, coupled with the economy in rent, the concentration of the staff, and the greater facilities for the display of goods and the execution of orders, will more than justify the proposed expenditure, which will itself prove a very profitable investment."

The amount required to pay the dividend on the preference capital, including the present offer, is £42,000 per annum, and the auditors' statement shows that the above dividend is covered nearly two and a-half times over without taking into account the profits to be derived from the proceeds of the present issue. Our readers are already fully informed concerning the very prosperous condition of this company whose progressive record was shown in the following climbing up of net profits for the five years from 1909-1913:—£47,342, £62,813, £79,384, £92,297 and £103,434.

Portland Railway Light and Power Co.—The list was to close on Wednesday in an offer of $1,064,000 first and refunding mortgage 5 per cent. sinking fund gold bonds (convertible issue) at 93 per cent.

Canadian General Electric Co.—According to the *Financial News*, the directors report that for 1913 a profit of $2,029,898 was earned, and, after deducting $470,934 for depreciation and $222,655 for interest, the net balance is $1,336,309. Deducting from this dividends on preference and common stock at rate of 7 per cent. per annum, and a bonus of 1 per cent. on the common, amounting in all to $776,634, there remains surplus earnings of $559,675, of which $328,134 has been added to reserve fund, and $231,541 to the balance of $682,391 at credit of profit and loss. The reserve now amounts to $2,700,000, the balance at credit of profit and loss to $913,932, making a total surplus of $3,613,932, equal to 36·13 per cent. of the share capital. There has also been accumulated a reserve for depreciation now amounting to $1,537,605. During the year the directors acquired all the property, &c., of Allis-Chalmers-Bullock, Ltd., of Montreal, and the property and assets of the Stratford Mill Building Co.

Indian Electric Supply and Traction Co., Ltd.—The directors report (according to the *Financier*) that the surplus on the year's working to December 31st, in Cawnpore, was £10,145, against £8,458 in 1912. London expenditure was £1,335, against £746 in 1912, and, after providing for debenture interest, £3,600, there remains a net profit of £5,226, plus £1,834 brought forward. The directors have placed £3,000 to reserve, and they recommend a dividend of 4 per cent. for the year, which will absorb £3,120, carrying forward £939. A chimney, an economiser, and a condenser were built and installed during the autumn, and have been got to work since the new year opened, the benefits of which are now being felt.

Middleton Electric Traction Co., Ltd.—The annual meeting was held in London on May 1st. Lord Vaux of Harrowden, the chairman, said that they had carried 172,018 more passengers, run 5,000 more miles, and earned £1,211 more in traffic receipts than in 1912. There was reason to believe that the improvement would continue.

Sao Paulo Tramway, Light and Power Co., Ltd.—The directors have declared a dividend of 2½ per cent., payable May 1st.

British Westinghouse Electric and Manufacturing Co., Ltd.

Mr. J. Annan Bryce, M.P. (chairman), presided on Monday at Hamilton House, E.C., over the fourteenth annual meeting of the above company.

The Chairman, in moving the adoption of the report (Elec. Rev., page 588), said they would have heard with sorrow the news of the death of Mr. Westinghouse, who, though he had been ailing for some time, retained a keen interest in the development of all the businesses of which he had been the founder. He was a man of very remarkable powers, which enabled him to become a pioneer in many fields of engineering. Since the last annual meeting, as they knew, the shareholders had been called together to approve a scheme for the reduction of the capital. They approved that scheme, and, in due course, it was sanctioned by the Court. The accounts now before them were based on the reduction made by that scheme, and, as they would see, the capital values of their shares were now respectively £2 per preference share, and £2 per ordinary share, while the assets upon the other side of the account had been correspondingly reduced. In the process of carrying out this scheme, the balance to the credit of profit and loss account, £66,895, as per last balance-sheet, had been absorbed, so that the profit and loss account this year started without anything brought forward. With regard to the accounts, he would first deal with the balance-sheet. On the debit side he had already referred to the first two items. The next item, prior lien debentures, showed a reduction on last year's account of £6,700 representing the debentures purchased on the market, and others drawn by ballot to meet the requirements of the trust deed for the year. The item 4 per cent. mortgage debenture stock, £1,241,353, remained as before. The item sundry creditors and credit balances, £262,499, was somewhat in excess of last year, as was natural in view of the increase in the business. Reserve for employers' liability remained as before. On the credit side, the first three items—purchase money of patents, works, machinery plant, &c.—now stood at the figures to which they were adjusted by the reduction of capital, except that the latter had been increased by the necessary expenditure during the year under review and again reduced by the amount of depreciation for the year. Stock and material on hand, £737,566, showed an increase of about £96,000 over last year, which was accounted for by the increased business. Completed work on contracts, £251,000, showed only a small increase of about £1,700. This was very satisfactory as showing that the improvement in the rate of collections had kept pace with the increase in the volume of business. Sundry debtors, less reserve, £207,107, were about £30,000 less than last year, which further illustrated the improved rate of collections. Shares and debentures in other companies were £172,610. This item showed a considerable reduction on the previous year's figures, owing to values having been written down on the reduction of capital, leaving the two chief investments, which were shares in the Clyde Valley Electrical Power Co. and the Traction and Power Securities Co., at amounts which, in the directors' opinion, represented their value. Both these securities continued to improve, and there was reason to hope that before long the former would be in a position to enter upon a dividend-paying stage, while the latter had recently declared a small dividend at the rate of 4·6d. per share, or about 2·8 per cent. Bills receivable and cash showed a considerable increase over last year, largely due to the continued improvement in the rate of collections. With regard to the profit and loss account, the net profits compared as follows with those of the previous five years: 1913, £106,494; 1912, £41,074; 1911, £20,708; 1910, £12,437; 1909, loss, £798; 1908, loss, £7,446. They would see that there had been steady and continuous progress for the last six years. After providing for the usual charges for debenture interest, redemption of prior lien debentures and other fixed charges, there was a net profit for the year of £106,494 to be dealt with. Out of this the directors had placed £50,000 to general reserve, leaving a balance of £56,494, out of which they recommended the payment of a dividend at the rate of 5 per cent. on the £1,000,000 of preference shares, and the carrying forward of £6,494 to the next year's accounts. He was sure they would agree that it was a sound policy to take the opportunity of good years to establish a reserve against the vicissitudes of trade. It was desirable in their business to have a good surplus in order to enable them to take advantage of any lucrative contracts that might offer, but which, in some cases, might necessitate their being out of pocket for long periods. The company, in common with other kindred concerns, had had a favourable year, better than they had reason to hope when he addressed them at the last annual meeting, though there were indications at that time of an appreciable improvement over the year 1912. Orders had come in well, and, he was glad to say, at somewhat better prices. Perhaps the most important order secured by them, of which, no doubt, many of them were aware, from references in the Press, was that from the London and South-Western Railway Co. for train equipments in connection with the electrification of their suburban traffic. Compared with those of 1912, the orders received for apparatus of their own manufacture showed an increase of 40 per cent. Whether the current year would prove to be as favourable as last it was too soon to hazard an opinion, but the first three months did not show any appreciable falling off. There were, however, indications of a slackening in trade generally. The directors were taking advantage of every opportunity to increase the business of the company both at home and abroad. Very friendly relations existed between the company and the Westinghouse Continental companies, and an increase in their business owing to those connections might be anticipated.

Mr. E. A. Goulding seconded the motion.

Mr. F. Tomkinson asked whether the directors intended to use the £50,000 placed to reserve as a fund for equalising dividends.

The Chairman said he did not know that they had in view any special use for the fund, but of course the board did not enter on the payment of a dividend without seeing their way to continue paying it.

Mr. H. W. Birks, as one who, he said, had made himself disagreeable in past years, heartily congratulated the board on the improved position, and also on the fact that the company had settled the dispute with the Underground Railway Co. in a friendly way. He suggested that shareholders would be glad to learn how that matter had been settled.

The Chairman said the company for years had an account against the Underground Co. for about £87,000 for plant supplied, with which they gave a guarantee as to coal consumption. The plant exceeded the coal consumption guaranteed, and the Underground Co. made counterclaims. The matter came before the Hon. Alfred Lyttleton for arbitration, and he gave an interim judgment which raised legal questions. These question were submitted to the Divisional Court, who decided against them, and they went to the Appeal Court, who also decided against them. On going to the House of Lords, however, the decision was in their favour. Then the matter was referred back to the arbitrator for assessment, and, unfortunately, he died. The two companies then came to the conclusion to settle the matter by bargaining between themselves, and this was done. By carrying the case to the House of Lords they saved some £70,000 or £80,000. As a result of the final settlement they lost £52,000, and they thought they came off very well. The contracts were accepted and guarantees given at a time when undoubtedly the experience gained did not justify such guarantees being given. In those early days the business was done without a profit, but now no business was done without profit.

The report was then adopted.

STOCKS AND SHARES.

Saturday Afternoon,

Why unfortunates connected with a technical weekly should be obliged to spend their Saturday afternoon before Easter in ministering to the wants of probably unappreciative readers, instead of taking the air in one of London's secluded spots—Hyde Park, for instance—the wit of the financial paragraphist declines to comprehend. However, there it is; so we may as well dip our pen into the ink of the martyr and go ahead with it.

The Stock Exchange markets have resumed an appearance of strength and confidence. Politics, as the all-absorbing factor, have given way to the sweet reasonableness of cheap money. Consols have gone a-soaring; money is unlendable at 1½ per cent.; the Bank Rate is expected to come down after Easter, and all the investment markets sing for joy.

Even the menace held out to the Home Railway industry, in consequence of the strike in South Yorkshire, has availed merely to check the tide of bullishness in that department. All sections of the market have hardened. Particular attention has been paid to high-yielding stocks of the steam variety; but the Undergrounds lagged a little behind the rest by reason of the fact that there is still something of a stale bull account left in Metropolitans and Districts. Since we wrote, however, there are moderate improvements in both of these, while Underground Electric Incomes have also strengthened, though the £10 shares are ⅛ down. Prices of the London Traction descriptions are well maintained, but there is no movement calling for special notice. The new Metropolitan Consolidated stock, with deferred dividend—given in payment of Great Northern and City Railway shares—is quoted at 27—30, and the company's 3½ per cent. Preference, ranking for dividend from July 1st, 1916, is called 65—75.

Electricity Supply shares are better. The feature of the week has been the over-subscription—and by a substantial amount—of the new County of London Ordinary and Preference shares. This came as rather a surprise to the market, which had been expecting that the issues would be just covered, if that, by the proprietors, seeing that the differences between the quotations of the old and the new were not greatly in favour of the latter. Upon its becoming known that the issue had been over-subscribed, a premium of 7s. 6d. was established on both the new Ordinary and the new Preference. The allotments, we understand, were made yesterday (Friday) afternoon.

The existing County of London Ordinary shares have advanced to 12⅛, and the Preference to 11⅞, while rises have also occurred in the Ordinary and Preference shares of the Charing Cross Company. City Lights are ¼ higher. Speculation in them has fallen off in marked fashion; of its revival, however, and that before very long, there cannot be much doubt, having regard to the speculative possibilities which lie in the hope that the Corporation may elect to come to terms with the company, instead of allowing the concern to drift into the hands of the County Council.

Brazilian stocks and shares of all kinds are swayed by the movements of the rate of exchange cabled daily—sometimes twice a day—from Rio. Down to 15⅞d. the other day, it has since recovered to nearly 1s. 4d., and its rapid gyrations drag the prices of Brazilian securities after it in fashion somewhat bewildering. Brazilian Tractions fell to 83, recovered to 85⅛, and then settled down to 84½. The bonds of the Tramways Companies—Rio and Sao Paulo—have held their substantial improvements. The Government of Brazil is expected to steer through its present difficulties without having recourse to funding its interest payments, or making some other temporary composition with its creditors. Hence, stocks and shares in companies Brazilian have followed the example of the Government bonds, and are showing a much better disposition generally. Para Railway Ordinary constitute the inevitable exception, being ½ lower.

Mexican matters, too, are thought to be progressing favourably towards some kind of an early settlement. President Wilson and General Huerta appear now to have more consideration for peace than they have displayed throughout the course of the past six months, and the result is reflected clearly enough in most Mexican securities. Those of the utility companies are steady, showing little alteration of importance on the week. But the tone is more confident, and the pressure to sell has been sensibly relaxed. Mexico Trams are 1½ to the good.

La Plata Trams are unaffected by the directors' decision to pay the dividend on the 6 per cent. Preference shares for the half-year to September, 1912.

Marconis are once more in the limelight. The price fell to 3⅜, as we noticed in our last article, on the assumption that the American Marconi Company would not be able to repeat even its tiny dividend performance of a year ago. Americans dropped to 16s. at one time, Canadians to 8s. 3d. There seems to be some doubt, however, as to the certainty that the American Marconi Company will pass its dividend; and a smart recovery, to 3½ buyers, occurred in the price of the parent shares, which had the effect of toning up the quotations for the subsidiaries. The rise started with a good deal of quiet option buying on behalf of Continental operators; and rumour ran round to the effect that the company itself is doing exceedingly well.

The Great Northern Telegraph Company has declared the usual final dividend of 15 per cent., making 20 per cent. for the year, and the price of the shares is unchanged at 33. Telegraph Constructions at 37 are again 10s. lower, raising the yield to 6 guineas per cent. on the money. British Insulated are also dull, another 5s. fall reducing the price to 9½. The Automatic Telephone Company's report indicates steady progress. British Westinghouse were sold by people who had bought on anticipation of a good report; when this materialised they took their profits. The 4 per cent. Debenture stock is, however, the only issue to show a change in the nominal quotation. Willans & Robinson Debenture stock has weakened a point. The electrical "strike" has been almost disregarded.

There was a pleasant little dinner the other night, when first-hand information, almost as pleasant, was given concerning some of the leading light and power companies of Canada and the United States. The strides which these are making are comparable in importance only to the fresh fields for extension that lie around the first-class undertakings of the Montreal and Shawinigan description.

Within the last day or two papers have been seen in the market having references to the new issue of Preference shares by the South London Electric Supply Corporation, and the prospectus is out of the substantial amounts of Ordinary and Preference capital offered by the General Electric Company. Brief details have been given here previously of these emissions. New issues are being accorded so flattering a welcome just now, that fresh additions to the list are likely to be made daily before the holidays, and the cheapness of money, which has much to do with the new issue successes, is almost certain to continue for some time to come.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.		No. of weeks.	Total to date.		Route miles open.	
		£	£		£	£		Inc.
Bath	Mar. 5	2,891	+ 176	12	8,466	+ 164	..	..
Blackpool-Fleetw'd	„ 28	1,225	— 889	12	3,118	— 799	8	..
Bristol	„ 27	59,546	— 313	13	90,342	+ 3,731	30·5	..
Brit. Elec. Trac. Co.	„ 27	204 043	2 766	..	..	..	429·8	1·25
Chatham and Dist.	„ 26	1,287	139	12	9,761	— 42:	14·98	..
Cork	„ 26	1,869	— 34	12	5,386	— 16	9·89	..
Dublin	„ 27	21,496	— 5·7	13	64,206	— 2,782	54·25	..
Hastings	„ 25	3,032	— 5·3	12	8,496	— 123	19·3	..
Lancashire United	„ 25	6,109	+ 132	12	18,407	+ 1,806	42	3
Llandudno-Col. Bay	„ 27	883	— 318	17	2,591	— 309	6·5	..
London United ..	„ 27	22,209	—1,226	13	66,430	— 560	..	..
Tyneside	„ 25	1,953	— 350	12	5,685	— 225	11	..
Anglo-Argentine ..	„ 25	130,136	+ 4,716	12	685,255	+ 22,100	..	..
Auckland	„ 18	24,382	+ 3,766	36	182,422	+ 3,3a7	25·42	1·31
Calcutta	„ 28	17,864	+ 844	..	..	+ 2,8 2	..	..
Kalgoorlie, W.A. ..	Feb.	2,069	..	8	4,509	..	20·5	..
*Madras	Mar. 1	1,929	— 137	18	11,215	+ 1,921	15·25	..
Montevideo ..	March	52,630	— 510	21	170,531	+ 856	..	..
Cen. London Rly.	Mar. 28	21,243	+ 1,'60	13	67,773	— 1,575	6·78	·4
City & S. Lon. Rly.	„ 28	11,304	— 305	..	37,028	— 2,209	7·26	..
Dublin-Lucan Rly.	„ 27	463	— 88	12	1,987	— 104	7	..
L'pool Overh'd Rly.	„ 29	6,429	+ 139	13	21,266	+ 653	6·6	..
London Elec. Ry. Co.	„ 28	58,955	+ 3,005	13	190,7 0	+ 2,510	21·25	..
Mersey Railway ..	„ 28	8,78?	+ 46	18	2?,286	+ 111	4·5	..
Metropolitan Rly.	„ 29	70,316	+ 6,577	18	231,724	+ 20,539	29·25	8·5
Met. District Rly.	„ 28	53,417	+1,527	13	172,470	+ 1,585	25	..

Two weeks.

SHARE LIST OF ELECTRICAL COMPANIES.

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations April 3rd.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Bath Trams, Pref. Ord.	1	Nil	..	⅞ — 1	..	Nil
Do. 5 % Pref.	1	5	5	9/16 — ⅝	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	69 — 74	+1	6 1 7
Brit. Elec. Trac., 6 % Pref.	100	..	..	15½ — 17½	..	..
Do. Do. Deferred	100	..	..	6½ — 8½	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	89 — 92	..	6 10 5
Do. 7 % Non-Cum. Pr'f.	100	8	..	56 — 59	..	5 1 8
Do. 5 % Perp. Deb.	100	5	5	98 — 95 xd	..	5 1 0
Do. 4½ % 2nd Deb.	100	4½	4½	79 — 82	..	5 9 9
Central London Railway, Ord.	100	8	8	57 — 62	..	4 16 9
Do. Gtd. Assented	100	..	4	81 — 83	..	4 16 5
Do. Pref.	100	4	4	68 — 73	..	5 9 7
Do. Gtd. Assented	100	..	4	82 — 84	..	4 15 8
Do. Def.	100	2	2	40 — 45	..	4 9 0
Do. Gtd. Assented	100	..	4	79 — 81	..	4 18 7
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	95 — 97	..	5 3 1
Do. Do. 1896	100	5	5	92 — 95	—1	5 5 0
Do. Do. 1901	100	5	5	89 — 92	..	5 8 8
Do. Do. 1908	100	5	5	89 — 92	..	5 8 8
Do. 4 % Deb.	100	4	4	88 — 90	..	4 9 0
Hastings Trams, 6 % Pref.	1	6	6†	⅞ — 1	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	65 — 70 xd	..	6 8 7
Isle of Thanet Trams, 5 % Pref.	5	2½	3	2 — 2½	..	6 0 0
Do. 4 % Deb.	100	4	4	71 — 76	..	5 5 8
Lancashire United, 5 % Deb.	100	5	5	87 — 89	..	5 12 4
London and Suburban, Ord.	1	..	..	3/32 — 5/32	..	..
Do. Do. 5 % Cum. Pref.	1	..	5†	⅝ — ¾	..	6 13 4
Do. Do. 4½ % 1st Deb.	100	4½	4½	79 — 84	..	5 7 2
London Elec. Railways, 4 % Deb.	100	4	4	90 — 92	+1	4 7 6
London United Trams, 4 % Deb.	100	4	4	60 — 64	..	6 5 0
Metropolitan Railway Consol.	100	1⅝	1⅝	42⅝ — 43½	+ ⅛	3 15 2
Do. Surplus Lands	100	2⅝	2⅝	63 — 65	..	4 4 7
Do. 3½ % Deb.	100	3½	3½	87 — 89	..	3 18 7
Do. 3½ % Pref.	100	3½	3½	82 — 84	..	4 3 4
Do. 3½ % Con. Pref.	100	3½	3½	80 — 82	..	4 5 4
Metropolitan District Ord.	100	Nil	..	28⅜ — 29½	+ ⅛	Nil
Do. 6 % Deb.	100	6	6	138 —141	..	4 5 1
Do. 4 % Deb.	100	4	4	93 — 95	..	4 4 3
Do. 4 % Prior Lien	100	4	4	97 — 99	..	4 0 10
Do. 4½ % First Pref.	100	4½	4½	84 — 87	..	5 3 6
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	89 — 92	..	4 17 9
Do. 5 % Deb.	100	5	5	85½ — 88½ xd	..	5 13 0
Potteries, Ord.	1	3½	..	3/32 — 5/32	..	..
Do. 5 % Pref.	1	5	5	1/32 — 3/32	..	7 12 8
Do. 4½ % Deb.	100	4½	4½	84 — 87	..	5 3 6
South Metro. Trams, 6 % Pref.	1	6	6†	⅜ — ½	..	8 0 0
Do. 4 % Deb.	100	4	4	66 — 70	..	5 14 4
Underground Elec. Railways	10	..	..	27 — 8½	— ⅛	Nil
Do. "A"	1/-	..	..	3/32 — 5/32	..	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	112 —114	..	5 5 3
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 0
Do. 6 % Income	100	6	6	90 — 91	+ ⅛	6 11 10
Yorkshire (West Riding). Ord.	5	Nil	..	1/32 — 3/32	..	Nil
Do. 6 % Pref.	5	8	4	4 — 4½	..	4 9 0
Do. 4½ % Deb.	100	4½	4½	83 — 86	..	5 4 8

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5½	5½	4⅞ — 4¾	—1/32	5 12 10
Do. 2nd Pref.	5	5½	5½	4⅝ — 4⅞	..	6 0 7
Do. 4 % Deb.	100	4	4	92½ — 94½	..	4 4 8
Do. 4½ % Deb.	100	4½	4½	97 —100	..	4 10 0
Do. 5 % Deb.	100	5	5	96½ — 98½	..	5 1 6
Auckland Trams, 5 % Deb.	100	5	5	103 —106	..	4 14 3
Bombay Elec. S. & Trams, Pref.	10	6	6	10⅜ — 11½	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	94½ — 96½	..	4 13 3
Do. 5 % 2nd Deb.	100	5	5	98 —100	..	5 0 0
Brazilian Traction, Light and Power	$100	6	6†	89⅜ — 85½	+1½	7 0 2
Brisbane Trams Invt., Ord.	5	8	8	7½ — 8	..	5 0 0
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	98 —101	..	4 9 1
B. Columbia Elec. Rly., Def.	100	8	8†	117 —121	+1	6 12 4
Do. Pref. Ord.	100	6	6	105 —109	+1	5 10 1
Do. 5 % Pref.	100	5	5	101 —104	..	4 16 2
Do. 4½ % 1st Mort. Deb.	40	4½	4½	98 —101	..	4 9 1
Do. 4½ % Vancouver Deb.	100	4½	4½	94 — 98	..	4 12 0
Do. 4½ % Con. Deb.	100	4½	4½	93½ — 95½	—1	4 9 1
Calcutta Trams, Ord.	5	7½	5†	6⅛ — 6⅞	..	5 11 1
Do. 5 % Pref.	5	5	5	5 — 5⅛	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	96 — 99	..	4 11 0
Cape Electric Trams	1	5	5	⅝ — ¾	..	6 13 4
City Buenos Aires Trams (1904)	5	5	5	5¼ — 5⅜	..	4 10 11
Do. 4 % Deb.	100	4	4	91 — 96	..	4 8 4
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	89 — 93	..	5 7 8
Havana Elec. Rly., 5 % Bonds	$1000	5	5	93½ — 97½	..	5 2 6
Kalgoorlie Elec. Trams	1	N	..	0 — 1/32	..	Nil
Do. 5 % A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6 % B Deb.	100	8	..	10 — 20	..	Nil
La Plata Elec. Trams, Ord.	1	..	..	⅛ — ⅜	..	..
Do. Pref.	1	4½d.	6	⅛ — 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	6	6†	1⅛ — 1⅜	..	4 7 8
Do. 6 % Pref.	1	6	6	1⅜ — 1⅝	..	5 1 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 4 2
Madras Elec. Tr., 6 % Cum. Pref.	5	6	6	4⅜ — 5½ xd	..	5 14 3
" Elec. Tr. (1904), Deb.	100	5	5	101 —103	..	4 17 0
Manaos Trams & Lt., 1st Deb.	100	5	5	79 — 82	..	6 2 0
Manila Elec. R. and Ltg., Bonds	$1000	5	5	98½ —100½	..	4 19 6
Mexico Trams Com	$100	7	7	74 — 77	+1½	..
Do. Gen. Con. 5 % Bonds	..	5	5	79 — 83	..	6 0 6
Do. 6 % Bonds	100	6	6	78 — 83	..	7 4 7
Para Elec. Rlys. & Lt., Ord.	5	10	10	8¼ — 4⅜	— ⅛	11 8 6
Do. 6 % Pref.	5	6	6	4 — 4½	..	6 13 4
Do. 5 % 1st Deb.	100	5	5	90 — 93	..	5 7 5
Rangoon El. Tr. & Sup., Pref.	5	6	6	5 — 5⅛	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	95 — 97	..	4 12 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	97 — 99	..	5 1 0
Do. 5 % Mort. Bonds	100	5	5	89 — 91 xd	..	5 10 0
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	$500	5	5	98 —101	..	4 19 0
Singapore Trams, 5 % Deb.	100	5	5	88 — 92	+2	5 8 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	95 — 97	..	5 3 0
Un. Elec. Trams Monte Video	5	7	7	4⅜ — 5⅛	..	6 16 7
Do. 6 % Pref.	5	6	6	4⅜ — 5½	..	5 14 3
Do. 5 % 1st Deb.	100	5	5	94 — 97	..	5 3 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	93½ — 95½	..	4 14 3

ELECTRICITY SUPPLY AND POWER COMPANIES.—HOME.

Bournemouth & Poole, Ord.	10	6	7	9⅜ — 10⅜ xd	..	6 10 4
Do. 4½ % Pref.	10	4½	4½	9 — 10	..	4 10 0
Do. Second 6 % Pref.	10	6	6	10½ — 11½	..	5 11 7
Do. 4½ % Deb. Stock	Stock	4½	4½	94 — 97	..	4 12 9
Brompton & Kensington, Ord.	5	10	10†	8⅜ — 9½	— ⅛	5 8 1
Do. 7 % Cum. Pref.	5	7	7	8⅛ — 8½	— ⅛	4 0 0
Central Electric Supply, 4 % Guar. Deb.	100	4	4	91½ — 94½	..	4 4 8
Charing Cross, West End & City	5	5	6	4⅞ — 5⅛	+ ⅛	5 11 7
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 5	+ ⅛	4 10 0
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	4 — 4½	+ ⅛	5 0 0
Do. Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Chelsea, Ord.	5	5	5	4⅜ — 5 xd	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	97 — 100	..	4 10 0
City of London, Ord.	10	9	10	17 — 18	+ ½	5 11 1
Do. 6 % Cum. Pref.	10	6	6	12⅜ — 13⅜	..	4 7 8
Do. 5 % Deb.	Stock	5	5	116 — 120	..	4 7 4
Do. 4½ % Second Deb.	100	4½	4½	100 — 103	..	4 8 1
County of London, Ord.	10	6	7	11⅞ — 12⅜	+ ⅛	5 13 2
Do. 6 % Pref.	10	6	6	11⅝ — 12⅛	+ ⅛	4 19 0
Do. 4½ % Deb.	Stock	4½	4½	102½ — 105½	..	4 5 9
Do. 4½ % Second Deb.	Stock	4½	4½	100 — 103	..	4 7 5
Edmundson's, Ord.	£8	..	..	⅜ — ⅝	..	Nil
Do. 6 % Cum. Pref.	5	6	6	3⅞ — 4½	..	7 1 2
Do. 6 % Non-Cum. Pref.	5	..	..	1⅝ — 2	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	84 — 87	..	5 3 6
Folkestone	5	6	6	4¼ — 4⅝ xd	..	6 6 4
Do. 5 % Cum. Pref.	5	5	5	4¼ — 4⅝ xd	..	5 5 3
Do. 4½ % First Deb.	100	4½	4½	93 — 95	..	4 14 9
Hove	5	8	9	8½ — 9	..	5 0 0
Kensington & Knightsbridge, Ord.	5	8	9	7⅝ — 8	..	5 12
Do 4 % Deb.	Stock	4	4	90 — 92	..	4 7 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	76 — 80	..	5 12 0
London Electric, Ord.	3	2½	3	1⅜ — 1⅝	..	5 2 7
Do. 6 % Pref.	5	6	6	4⅜ — 5⅛	..	5 17 3
Do. 4 % First Mort. Deb.	Stock	4	4	93 — 96	..	4 4 1
Metropolitan	5	4½	4½	3⅝ — 3⅞	..	5 16 3
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 5	..	4 10 0
Do. 4½ % First Mort. Deb.	Stock	4½	4½	97 —100	..	4 10 0
Do. 3½ % Mort. Deb.	Stock	3½	3½	83 — 86	..	4 1 4
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	100 —103	..	4 17 1
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9⅞ — 10⅛	..	5 14 3
Oxford	5	7	7	5⅛ — 6⅜	..	5 11 0
St. James' and Pall Mall, Ord.	5	10	12	9⅞ — 9¾	..	6 3 1
Do. 7 % Pref	5	7	7	6⅞ — 7⅛	..	4 18 3
Do. 3½ % Deb.	100	3½	3½	83 — 86	..	4 1 4
South London, Ord.	4	5½	5½	2⅜ — 2⅝ xd	..	6 10 4
Do. 5 % First Mort. Deb.	100	5	5	98 — 101	..	4 19 0
South Metropolitan, 7 % Pref.	1	7	7	1⅜ — 1⅝	..	5 6 8
Do. 4½ % First Deb. Stock	100	4½	4½	94⅛ — 97⅛ xd	..	4 12 4
Urban, Ord.	£8	Nil	..	⅜ — ⅝	..	..
Do. 5 % Cum Pref.	5	3†	4	2⅜ — 2⅝	— ⅛	6 3 1
Do. 4½ % First Mort. Deb.	100	4½	4½	85 — 88 xd	..	5 12 3
Westminster, Ord.	5	10	10	8½ — 9	..	5 11 1
Do. 4½ % Cum Pref.	5	4½	4½	5⅛ — 5⅜	..	4 4 9

* Unless otherwise stated, all shares are fully paid. † Interim Dividend. ‡ 8s. Cash and 2% in Funded Certs.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICITY SUPPLY AND POWER—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for		Closing Quotations April 3rd.	Rise + or Fall —	Present Yield p.c.
Adelaide, 6 % Pref.	£	6	6	5 — 5½	..	£ s. d. 5 14 3
Calcutta, Ord.	£	8½	8†	7⅞ — 8	..	5 6 3
Do. 5 % Pref.	£	5	5	5 — 5¼	— ⅛	4 15 3
Calgary Power, 1st Mort. Bds.	100	5	5	90½ — 92½	..	5 8 0
Canadian Gen. El. Com.	$100	7	8	111 —115 xd	..	6 16 9
Do. 7 % Pref.	$100	7	7	119 —124 xd	..	5 9 5
Cordoba Lt., Power and T., Ord.	1	5	..	7/16 — ⅝	..	7 12 0
Do. 5 % Deb.	100	5	5	87 — 90 xd	..	5 11 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	87 — 89	..	6 14 10
Elec. Supply Victoria, 6 % 1st Mort. Deb.	100	5	5	91 — 94	..	5 6 5
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	93½—95½	+ ½	5 4 9
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	3/32 — 5/32	..	Nil
Do. 6 % Pref.	1	6	6†	29/32 — 31/32	..	10 11 10
Kaministiquia Power, 5 % G. Bs.	$500	5	5	102 —104	..	4 16 2
Madras, Ord.	£	Nil	..	1/32 — 1/16	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	103½—106½	..	4 14 0
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	65 — 70	..	7 2 10
Mexican Lt. & Power, Common	$100	4	4†	44 — 47	..	..
Do. 7 % Cum. Pref.	$100	7	7	78 — 82	..	8 10 8
Do. 5 % 1st Mort. Gold Bds.	..	5	5	78 — 83	..	6 0 6
Do. 5 % 2nd Mort. Bonds	100	5	5	65 — 69	..	7 4 11
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	* 100	1912. 5	1913. 5	54 — 59	..	£ s. d. ..
Montreal, Lt., H. and Power	$100	9	10†	230 —235	..	4 5 0
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5a	5a	10 — 20	..	..
River Plate, Ord.	Stock	10	..	245 —255	..	3 18 5
Do. 6 % Non-Cum. Pref.	Do.	6	6	103 —108	..	5 11 1
Do. 5 % Deb. Stock	Do.	5	5	101 —103	..	4 17 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102 xd	..	4 8 3
Shawinigan Water, Capital	$100	5½	6†	138 —142	..	4 4 3
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	..	4 11 7
Do. 4½ % Per. Deb.	Stock	4½	4½	101 —103	..	4 7 8
Toronto Power, 4½ % Deb.	Do.	4½	4½	95 — 97	..	4 12 9
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	88 — 90	..	5 11 1
Victoria Falls Power, Pref.	1	6	6	23/32 — 25/32	..	7 13 4
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	102 —104	+1	5 15 5

MANUFACTURING COMPANIES.

Aron, Ord.	£	7	..	33/64 — 37/64	..	5 5 0
Do. 6 % Pref.	£	6	6	3/4 — 7/8	..	6 17 2
Babcock & Wilcox	£	16	14†	31/32 — 33/32	..	4 18 6
Do. Pref.	£	6	6	1 1/16 — 1 1/16	..	4 8 6
British Aluminium, Ord.	£	..	..	1 1/16 — 1 1/16	..	..
Do. 6 % Cum. Pref.	£	6	6	1 — 1	..	6 0 0
Do. 6 % Prior Liens Debs.	100	5	5	96 — 99	..	5 1 0
Do. Deb. Stk.	100	5	5	88 — 93	..	5 7 6
B.I. & Helsby Cables	£	10	13	9½ — 9⅝	— ⅛	6 18 4
Do. Pref.	£	6	6	6⅞ — 6⅞	..	4 14 1
Do. Deb.	100	4½	4½	101 —104	..	4 6 9
British Thomson-Houston, Deb.	100	4½	4½	92 — 94	..	4 15 9
British Westinghouse, Pref.	£	Nil	5	1 1/32 — 1 1/16	..	6 5 0
Do. Deb.	100	4	4	78 — 76	—1	5 6 8
Do. 6 % Prior Lien	100	6	6	100 —103 xd	..	5 16 6
Browett, Lindley, Ord.	£	..	..	2/- —3/-	..	Nil
Do. Pref.	£	..	..	6/- —8/6	..	Nil
Brush, 7 % Pref.	£	Nil	..	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	88 — 86	..	5 17 8
Lo 4½ % Deb.	100	4½	4½	39 — 43	..	10 9 6
Do. 4½ % Second Deb.	100	4½	4½	23 — 27	..	16 18 4
Callender's Cable	£	15	5†	11⅜ — 12½	..	6 0 0
Do. Pref.	£	5	5	4 13/16 — 5 1/16	..	4 16 5
Do. Deb.	100	4½	4½	97 —100	..	4 10 0
Castner-Kellner	£	20	22½	2½ — 2⅝	..	..
Do. Deb.	100	4½	4½	104 —107	..	4 4 1
Crompton & Co., Deb.	100	5	5	83 — 85	..	5 17 8
Dick, Kerr	£	Nil	..	3/8 — 5/8	..	..
Do. Pref.	£	6	6	1 1/16 — 1 3/16 xd	..	7 7 8
Edison & Swan, A, £3 paid	£	Nil	..	1/16 — 1/16	..	Nil
Do. fully paid	£	Nil	..	1/16 — 1/8	..	Nil
Do. 4 % Deb.	100	4	4	58 — 62	..	6 9 1
Do. 5 % Second Deb.	100	5	5	62 — 67 xd	..	7 9 1
Electric Construction	£	5	..	17/32 — 21/32	..	7 12 6
Do. Pref.	£	7	7	1 1/16 — 1 1/8	..	6 11 7
Greenwood & Batley, Pref.	10	7	7	6¾ — 7½	..	9 13 2
Do. Deb.	100	5	5	92 — 94	..	5 6 5
General Electric, 6 % Pref.	10	6	6	10½ — 10⅝	..	5 14 3
Do. Deb.	100	4	4	84 — 88 xd	..	4 11 0
Henley's, Ord.	£	15	20	13⅛ — 14⅛	..	6 17 11
Do. Pref.	£	4½	4½	4 13/16 — 5 1/16	..	4 9 0
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
India-Rubber, G. & T.	£	7½	7½	10½ — 11½	..	6 10 5
Do. Pref.	£	5	5	8¾ — 9¼	..	5 5 3
Telegraph Construction	£	20	20	86 — 88	— ½	6 6 7
Do. Deb.	100	4	4	98 —100	..	4 0 0
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	4	64 — 68	—1	5 17 8
Do. B 4 % Cum. Pref.	100	..	..	50 — 55	..	..

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	£	4½	4½	6⅝ — 6¾	..	7 4 0
Do. 6 % Deb. Red.	Stock	5	5	94 — 97	..	5 3 0
American Telep. & Teleg., Cap.	$100	8	8	123 —125 xd	..	6 8 0
Do. Collat. Trust	$1000	4	4	91 — 94	..	4 5 3
Anglo-American Telegraph	Stock	3	3	64 — 67	..	4 9 7
Do. 6 % Pref.	Do.	6	6	109 —110	+ ½	5 9 4
Do. Def.	Do.	30/-	30/-	23½ — 24	..	6 5 0
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	..	4 16 2
Chili Telephone	£	8	..	7⅜ — 7⅝	..	5 5 0
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	80½ — 82½	..	4 17 0
Cuba Telegraph	£	6	6†	8⅜ — 9⅜	..	6 3 1
Do. 10 % Pref.	£	10	10	15⅜ — 16⅜	..	5 19 5
Direct Spanish Telegraph, Ord.	£	4	4	3¾ — 4 xd	..	5 0 0
Do. 10 % Cum. Pref.	£	10	10	7¼ — 8 xd	..	6 5 0
Direct United States Cable	£	4	4†	6⅝ — 7⅛	..	5 12 4
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	97 — 99	..	4 10 10
Eastern Telegraph, Ord. Stock	Stock	7	7	132 —135	..	5 3 8
Do. 3½ % Pref. Stock	Do.	3½	3½	77½ — 79½	— ½	4 8 1
Do. 4 % Mort. Deb.	Do.	4	4	96 — 98	..	4 1 8
Eastern Extension	£	10	7	128 — 129	..	5 8 9
Do. 4 % Deb.	Stock	4	4	94½ — 96½	..	4 3 0
Globe Telegraph and Trust	£	10	6	11½ — 11¾ xd	..	5 2 1
Do. 6 % Pref.	£	10	6	12½ — 13	+ ⅛	4 12 4
Great Northern Telegraph	£	10	20	82 — 84	..	5 17 8
Indo-European Telegraph	£	25	13	58 — 60	..	5 8 4
Mackay Companies Common	$100	5	5	85 — 88	..	5 13 8
Do. 4 % Cum. Pref.	$100	4	4	70 — 73	..	5 9 7
Marconi's Wireless Telegraph	£	20	20	3⅛ — 3⅝	+ 3/16	5 10 4
Do. 7 % Cum. Partic. Pref.	£	17	..	2 13/16 — 3 1/16	+ ⅛	5 10 4
Monte Video Telephone, Ord.	£	6	6	1⅜ — 1⅝	..	6 8 0
Do. 5 % Pref.	£	5	5	2 — 2	..	5 14 8
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	100 —101	+ ½	4 9 0
Oriental Telep. and Elec.	£	10	8†	2¼ — 2⅜	..	4 4 3
Do. 6 % Cum. Pref.	£	6	6	1 1/16 — 1 1/8	..	4 11 5
Do. 4 % Red. Deb.	Stock	4	4	87½ — 89½	..	4 9 5
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 —100	..	4 0 0
Reuter's	£	10	10†	8 — 9	..	11 2 2
Submarine Cables Trust	Cert.	6	6	196 —199	..	4 18 0
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	96½ — 98½	..	4 11 5
United River Plate Telephone	£	8	6†	6⅜ — 6⅞	..	5 16 5
Do. 5 % Cum. Pref.	£	5	5	5⅛ — 5⅝	..	4 9 0
West Coast of America	£	2½	2½	1 1/16 — 1 1/16	..	4 8 0
Do. 4 % Debs., 1 to 1,500 guar. by Bras. Sub. Tel.	100	4	4	96 — 99	..	4 0 10
West India and Panama Teleg.	£	10	12½	2⅜ — 2⅝	..	4 15 8
Do. 6 % Cum. 1st Pref.	£	10	6	9⅜ — 10⅛	..	5 18 5
Do. 6 % Cum. 2nd Pref.	£	10	6	9 — 9⅛	..	6 6 4
Do. 5 % Debs.	100	5	5	97 — 99	..	5 1 0
Western Telegraph, Ltd.	£	10	7	7	131— 132 xd	..	5 1 11
Do. 4 % Debs.	Stock	4	4	95½ — 97½	..	4 2 1
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	96 — 99	..	4 11 1

* Unless otherwise stated all shares are fully paid. † Interim dividend. a Paid in deferred interest warrants.

Bank rate of Discount 3 per cent., January 29th, 1914.

Copper.—The very interesting statistics relating to the annual output of copper for various countries, scheduled by Messrs. H. R. Merton & Co., are now to hand. From these it is evident that the output, or, at any rate, the apparent output, for 1913, was less by 19,735 tons than the output for 1912. The quantity is not large, and may be due to closer estimating, as one would not be inclined to suppose that the peak of the world's production has been already reached. The largest producer, the United States, comes out 5,785 tons less than the previous year, with 548,578 tons, or 56 per cent. of the total output. The next largest producer, Japan, has added 6,500 tons to last year's output, and has 72,000 tons to its credit. Mexico shows a heavy decrease—20,475 tons, on last year's output, 51,980 tons. Australia has dropped 440 tons, showing 46,580 tons for 1913. Chile shows an increase of 2,000 tons odd, and has 39,385 tons as its figure. Canada, with hardly any falling off, shows 34,365, thus beating Russia at 33,240, which, however, is a slight increase over last year. Peru shows 25,310, than which it has done considerably better in former years. Africa is coming on with 22,510 tons.

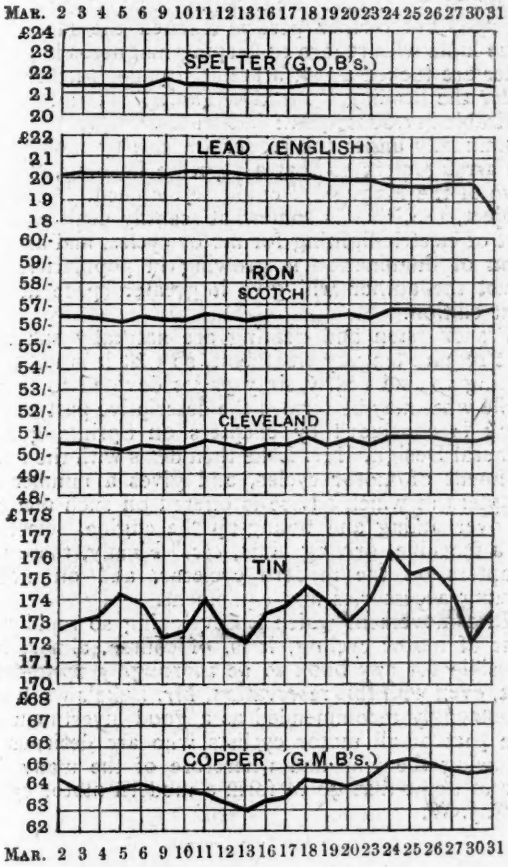
Of the European producers Spain and Portugal, with 53,835 tons, show a falling off of 5,095 tons on the quantity for the previous year.

Germany does 24,910 tons, very slightly under last year's, and Servia 6,275 tons, not its best output. England has 300 tons (estimated).

Of the above Australia and Japan have perhaps the most encouraging figures, the first having doubled its output in 13 years, and the second in seven years. Norway has one of the most steadily increasing outputs, now reaching 11,610 tons.

METAL MARKET.

Fluctuations in March.



The Electric Vehicle Committee.—At the last meeting of the Electric Vehicle Committee, on March 20th, it was decided to recommend to supply authorities and companies that for "off-peak" charging the maximum price should not exceed 1d. per unit on the supply authority's declared system and pressure. As to the price to be charged for electric energy during "peak load" hours, the Committee feel that very little charging should be necessary at such times, especially for commercial vehicles. Consequently they do not consider it desirable to make any recommendations as to a tariff, leaving it to each supply authority or company to fix its own rate for such hours. The committee suggest the wisdom of giving special encouragement for charging vehicles during the hours between 11 p.m. and 6 a.m., and they consider that the supply might be remuneratively given at a price of ¾d. per unit. It is also recommended that a scale of discounts be arranged to meet the case of large consumers, and that an additional discount of 20 per cent. off the above rates be given for all energy purchased by a consumer for re-sale and metered on the latter's own premises. The Committee recommend that the minimum charge for battery charging ought not to exceed 2s. It is proposed that this amount should only include the housing of the car upon the charging premises during such time as charging is proceeding, it being open to the supply authority or company to make a further charge should the owner of the vehicle desire to house it on the premises after the charging operation has been completed. A letter is being sent to supply authorities and companies embodying these recommendations. As to the standard charging plug, the Committee have reconsidered the matter of earthing, and, in view of the fact that under certain conditions the charging of the battery might be done direct off a high-pressure supply service through a resistance, they have thought it desirable to earth the framework of the chassis through the plug and receptacle by means of a third earthing conductor embodied in the main flexible charging cable. The Committee recommend that arrangements be made for this earthing in all cases. The Technical Sub-Committee are busy dealing with details appertaining to the plug, such as terminals, areas of contact, &c. They are also considering the question of size of battery cells and battery trays, charging voltages, &c.

REVIEWS.

Conversion Factors, Tables and Data for the Testing of Steel Conductor Rails. Middlesbrough: Ridsdale & Co. Price 6s.

This is a collection, in pamphlet form, of five sheets of notes and tables prepared with the object of simplifying the conversion from one to another of the various expressions for the resistance of steel conductor rails for electric traction purposes. The resistance is usually expressed in relation to the resistance of any equivalent copper rail, equal either in weight or in section, or it may be expressed in ohms per yard per pound, or per square inch section of rail. The conversion factors and the notes here given are of considerable use, but, for those accustomed to the use of a slide rule, the tables are superfluous, as are also the alternative methods of calculating. It is little less than a disgrace to the profession that several expressions for such an important quantity should be in general use, and the sooner the Engineering Standards Committee publish the result of their conference on the matter the better. It is to be hoped that the cumbrous and confusing "times copper" figure will be superseded by the logical and direct expression of resistance in ohms per yard per square inch rail section; or, failing this, ohms per yard, per lb., or ohms per yard of 100lb. rail.—J. B. S.

Small Power Wireless Installations. By M. Child. 1913. London: Percival Marshall & Co. Price 1s. net.

This volume represents a revised edition of a valuable serial article which recently appeared in the "Model Engineer." A number of books have now been written to cater for the needs of amateur wireless telegraphists, but none we believe, gives a better treatment than this of the subject as required by these readers. The author explains the construction of the essential apparatus connected with a modern radio-equipment, discusses the elementary theory of these apparatus and presents the data necessary to enable the average reader to calculate wave lengths, capacities, inductances, and coupling percentages, etc. It is assumed that the reader is familiar with, or at least understands, the nature and general function of such apparatus as induction coils, condensers, telephones, buzzers, ammeters, and Morse keys, etc. Too many books of this class have failed through endeavouring to cover these matters as well as wireless telegraphy and its application, all within a hundred pages or so. If the reader is not familiar with such elementary matters, he should study them in separate books. A single small treatise on wireless telegraphy, to be useful must, like the present volume, assume reasonable fundamental knowledge, *i.e.*, cater specifically for the man who wishes to extend some electrical knowledge or hobby to include wireless telegraphy.

After a brief indication of the general nature of wireless telegraphy, the author plunges at once into a general description of the aerial and earth wires, and the source of energy to be used. The long-spark fallacy is exposed, the desiderata of a transformer are specified, and the function and construction of condensers are explained. Chapter II deals at length with the purpose and construction of variable (sector) condensers and of inductances. We frequently wonder why, in the formula:—Frequency = Velocity of Propagation ÷ Wave Length, the velocity is not expressed as 300,000 km. per second, and the wave length in metres, yielding the frequency in kilocycles (kcy.).

Spark gaps form the chief subject matter of Chapter III; the author recommends cup and point electrodes, and illustrates the design and connections of

a useful 1-kw. set. The advantages of the rotary spark gap, in respect of preventing arching, are explained clearly. The principles of tuning and resonance are detailed in Chap. IV, a description of the actual apparatus required being postponed till Chap. IX is reached; the stress laid on this important subject is fully justified. The action and methods of coupling naturally follow for treatment in Chap. V, and here, again, the autnor is to be complimented on a clear exposition of matters which frequently perplex the amateur. In Chap. VI, the author deals with detectors and telephones, and presents a useful table showing the relative sensitiveness, reliability and durability of various detectors. The construction, adjustment and working of specific types of detectors (electrolytic, carborundum, silicon and others) are dealt with in Chap. VII, and in the next chapter the author discusses the theory, construction and action of the magnetic detector. The dimensions of inductances and condensers required for tuning purposes are discussed in Chap IX, and typical tuners are described suitable for use with various kinds of detectors. In the next chapter the author describes and illustrates the construction of a simple wave meter with lamp indicator, responding to only one wave length (say 300 m.), for amateurs' purposes. Chapters on buzzers and change-over devices and on aerials and earthing conclude this little work, which certainly represents a very successful attempt to meet the needs of the majority of amateur operators.

The Motor Cyclist's Handbook. By "Phœnix" (Chas. L. Lake.) Third Edition, Revised and Enlarged. London: Percival Marshall & Co. Price 2s. net.

Generally speaking, it may be safely asserted that when a work of a more or less technical character runs to three editions in the short period of eighteen months, such work has met "a long-felt want." This is the case with "The Motor Cyclist's Handbook," the object of which is to provide the ever-increasing army of motor cyclists with a practical manual on the construction and management of their machines. There was a time when all motorists were extremely enthusiastic about their knowledge of motor mechanics and their ability to cope with any derangements experienced when out driving, which, in the early days, were of a very frequent nature. Now that the motor car has become part and parcel of modern life, the motor enthusiast, although he still exists, only forms a fractional part of the motoring public, the majority of whom are not interested in mechanical details, they leaving such matters to their paid servants. Hence, so far as cars are concerned, practical manuals are not in such great demand as was the case some few years ago. With motor cycles, however, the position is different, and, indeed, there is every likelihood that it will remain so for a long time to come, for whether the motor cycle is used for pleasure or business, the rider is compelled to act as his own chauffeur, and must make himself capable of coping with any unexpected breakdown, which, although to a much lesser degree than formerly, has still, at times, to be contended with. It is probably due to this that the demand for Mr. Lake's book is being so well maintained.

The author, very properly, starts with the engine, the book opening with a capital chapter devoted to the four-stroke engine, followed by one dealing with the two-cycle motor—in the development of which, from an automobile point of view, the motor-cycling world is doing useful work—and one with twin and four-cylinder engines. The next chaper deals with the constructional details of petrol motors, and is followed by notes on compression, the carburettor and ignition. It is to the last-named chapter that we, naturally, look with special interest. In this connection we find that while the technical details of the high-tension magneto, now almost exclusively used to provide the vital spark on petrol automobiles of all kinds, are fairly fully dealt with, no advice is given, under the heading "Care of Ignition Appliances," as to the attention that must be given to the magneto. At first we thought it had been entirely omitted, but further perusal elicited the fact that some hints with regard to keeping magnetos in good order are tucked away, a hundred pages further on, under the heading "Ignition Faults." It might be advisable in a subsequent edition to bring these more prominently under the reader's notice by modifying the arrangement so that a separate heading, "The Care of the Magneto," could be included. Another subject, too, that is somewhat scantily dealt with is that of electric lighting for motor cycles, and as this form of illumination is growing in popularity, no doubt the author will give it greater space in his next edition.

Transmission and gearing are naturally subjects that require lengthy treatment, so that it is not surprising to find nearly sixty pages devoted to them, while what may be termed the descriptive part of the book is concluded by chapters on Springing and General Design. Mr. Lake then deals with the management of motor cycles, and gives a number of chapters in which advice is offered on such matters as overhauling and tuning-up the engine, selection of a machine, driving hints, etc. Finally, there are chapters on the modern cyclecar, and on motor cycling accessories and equipment.

In a movement which is developing so rapidly as that of motor cycling, it is, of course, almost impossible for any book to be thoroughly up-to-date, but, even with this reservation, Mr. Lake's work can be strongly recommended as a good investment on the part of all motor cyclists who are desirous of knowing the why and wherefore of the many different items that go to form a modern motor cycle. —C. J. W.

American Telegraph Practice. By Donald McNicol. London: Hill Publishing Co., Ltd. 1913. Price 17s. net.

This book claims to be a complete technical course in modern telegraphy, including simultaneous telegraphy and telephony.

After a short theoretical introduction, necessary to understand the principles upon which the art is based, a very full and detailed description is given of American telegraph methods, as far as apparatus and systems are concerned. The whole ground is covered from simplex sounder circuits to modern printing systems.

The portion of the book devoted to telegraph construction is, however, very small, being mainly confined to specifications of wire and cables.

Although, of course, for most telegraph men in this country the book will not be of much immediate utility, owing to the difference between the methods in vogue on either side of the Atlantic, yet it is good to learn what others are doing, and from this point of view the book can be recommended to all interested in the subject. Those of our readers who are brought into actual contact with American telegraph affairs will find the book of great utility.

It is throughout written very clearly. We have only noticed one point which could with advantage be modified in future editions. In discussing lightning effects, the author says that, among other manifestations, lightning may occur "as an alternating current of high frequency, having large capacity and high self-induction"! Of course, it is clear what he means, but the statement, as it stands, is vague, to say the least.

The book is well printed on good paper, and the diagrams and illustrations are very clear.

Telephone Cables. By J. C. Slippy. Pittsburg: From the Author. 1913. Price $2.50.

This small book may best be described as an American Telephone Cable Engineer's pocket-book. The ground covered includes specifications, plans and records, the running of cables, both overhead and underground, loading, maintenance and testing, and the costs of cables and cable work. The book concludes with an appendix containing tables of various data useful to the cable engineer.

The book contains a large amount of useful information in a small space, is well illustrated, and to anyone connected with American telephone cable work should prove valuable.

Factory Lighting. By C. E. Clewell. 1913. London: Hill Publishing Co. Price 8s. 4d. net.

Mr. Clewell's book on factory lighting is apparently written mainly for owners and managers of factories, but it is doubtful whether they would be able to dispense with the services of competent technical advisers, even after a careful study of his suggestions. Probably the slight doubt as to whether the book is intended primarily for the non-technical or the technical man is due to differences between American practice and English in regard to the employment of consulting engineers.

There is no doubt, however, that the book will be of considerable value to anyone interested in its subject. Mr. Clewell puts very clearly and forcibly the cash value of a good light, and his remarks on this point and on the desirability of keeping the lighting installation in thorough order should be taken to heart by every factory owner. It is only of recent years that there has been any appreciation of the fact that money spent on good lighting is a paying investment. Even to-day the majority of factory installations are carried out on the principle of getting just enough light to work by, irrespective of its proper application to the special conditions of the factory.

Anyone who has had experience of the trouble involved in persuading an owner to spend a penny more than the bare minimum required to get his factory wired will appreciate this.

The data Mr. Clewell has collected with regard to the improved output of a factory which results from good lighting, and especially his method of putting the value of good light in terms easily appreciated by the non-technical man, will help the advising engineer very considerably in his desire to have the lighting installation properly carried out, and properly looked after once it is done.

Mr. Clewell also has much useful information to impart with regard to the illumination that is desirable for various types of building, and gives many comparisons between old inefficient systems of lighting and more satisfactory systems that have been developed in their place. These will repay careful study by anyone interested in the subject, and this means everyone concerned in lighting work, for his examples include offices, drawing offices, factories of various kinds, power houses, etc., as well as the consideration of the special lighting desirable for machine tools, etc.

Whilst giving much information on all these subjects, Mr. Clewell fully appreciates the necessity of treating each case on its merits, and that it is useless to assume that the arrangement of lamps satisfactory in one factory will be equally satisfactory in another. Differences in the reflecting values of the walls and ceilings, for example, are obviously of vital importance. It is the existence of these variable factors that causes the doubt whether the book will be of much direct value to the factory owner without expert advice. Its value to him will rather be indirect by its advocacy of the general principle of the value of a good lighting system.

There is a very interesting chapter on the subject of "Lighting Maintenance and Records," but whilst there can be little doubt as to the value of proper maintenance, it is doubtful whether the rather elaborate proposals for recording the details of the lighting installation which Mr. Clewell suggests will be worth the considerable cost they would probably involve. It would have been interesting had Mr. Clewell been able to include some figures of the actual cost of keeping these records for specific installations of various types. In the same chapter occur some very striking figures showing the loss of light due to failure to clean globes and shades. One such test showed a drop of nearly 50 per cent. in the effective candle-power after only three weeks non-cleaning. The curves apparently are for lamps fitted with Holophane shades, which raises a question whether the deterioration would have been as considerable had a smooth shade of opal, Superlux, or some similar glass, or even metal, been used in place of the corrugated Holophane shade.

There are many other points of similar value brought out by Mr. Clewell, and the book is certainly worth close study by the lighting engineer. It should be added, that whilst the examples given are almost exclusively based on electric light, yet, as Mr. Clewell explains, the principle involved is the same whatever means of obtaining light be adopted, and for this reason the book should appeal to all classes of lighting engineers, and not only to the electrical engineers.

Aviation: An Introduction to the Elements of Flight. By Algernon E. Berriman. London: Methuen & Co., Ltd. Price 10s. 6d. net.

As has been the case with motor cars, motor cycles, and the other developments of the late 'nineties and the early years of the new century, the literature in connection with the subject of aviation and aeroplanes is rapidly growing in extent. Of the latest addition to such works—the one under notice—very little criticism can be offered, for its author is a gentleman peculiarly fitted to deal with the subject. Both as an engineer and as a journalist, he has had special facilities to make himself thoroughly conversant with all aspects of the subject of aviation, for until recently he was the technical editor of our contemporary, "Flight," and thus had greater opportunities than fall to the lot of most people.

The arrangement of the book does not follow the usual plan, for the historical part, which is generally given first, is relegated to the third section, so that, on reaching it the reader should be in a better position to appreciate the work of the pioneers. The first section deals with the fundamental principles of heavier-than-air flight, supplying the student with a knowledge of the technicalities of the science which is necessary in order to secure a proper grasp of the problems associated with flying that have been solved and those that still await solution. The second part is more particularly devoted to a consideration of the practical results that have been achieved, and refers in detail to the work of certain well-known pioneers such as Lilienthal and the Wright brothers. As has already been mentioned, the third section is largely historical, and gives an excellent recital of the progress that has been made since the days when the flight of birds first began to inspire men to emulation of their flying powers. The fourth division of the book is devoted to a series of appendices which, while having no exact or proper place in the body of the work, have been included to furnish the reader with a range of matter relating to such things as terminology, aeronautical clubs and institutions, bibliography, flying records, formulæ, etc.

We are somewhat in doubt as to the necessity or use of some of the tables and other data that are given in this section, a glance at which may possibly cause some would-be purchasers of the book to consider it too highly technical for them. Moreover,

were we invited to make suggestions, we should recommend a little fuller treatment of the chapter on "The Petrol Engine." It is largely, if not entirely, due to the improvements that have taken place in internal-combustion engines in recent years that aviation has become an actuality in place of the possibility of which so many long dreamed. In fact, it may almost be said that the theory of heavier-than-air flight had been well established for some years, and that it had come to a point when only the advent of a reliable prime mover could give the science a further impetus. It is therefore somewhat surprising that the author should dismiss this section in a chapter which, extending to only five pages, is more devoted to the question of petrol and other fuels than it is to the subject indicated by its title. The chapter relating to "Accidents," too, would seem to be somewhat disjointed, for it is not clear whether the quoted opinions and recommendations of the Royal Aero Club relate to one or a series of accidents, and, in any case, it would, we think, have been better to have briefly outlined the particular accident or accidents so as to afford the reader a clearer idea of what the Committee's opinions relate to.

On the whole, however, the author has succeeded in producing an instructive work, and one that should appeal to all who are taking more than a superficial interest in aviation. The text is well illustrated, and a useful index is provided.—C. J. W.

Village Electrical Installations. By W. T. Wardale. London: Whittaker & Co. Price 2s. net.

Probably no engineer whose travels have taken him into country districts in many parts of the Continent has failed to notice the extent to which electricity is used for all kinds of purposes, and to compare these conditions unfavourably with those that exist in this country. Abroad, no doubt, they have the advantages bestowed by water power and by the absence of the expensive systems of mains so often imposed on a supply company here by district councils and others, but, nevertheless, much of our failure to use electricity more extensively is due to our lack of energy in taking advantage of such opportunities as do exist. Mr. Wardale's book may help to overcome this defect.

There is little doubt that by giving careful consideration to the local conditions many small installations such as those he describes could be successfully worked, and could return larger dividends than he suggests. It is to be feared that if this were not the case it would not be easy to raise the capital unless the shareholders regarded the advantage of electricity as in itself a partial dividend. He speaks of no return the first year; four per cent. the second, and five per cent. subsequently, but this could hardly be regarded as a very attractive business investment.

Mr. Wardale's book is, perhaps, rather elementary for a technical man who may have in view the formation of a company to work a small village electricity supply, but many of his points will be worth careful consideration. This applies particularly to the statement that such schemes can rarely stand alone. They need to be tacked on to some other business so as to reduce capital cost for the site and buildings and running costs by enabling a man to spend only part time on the supply station work. It is not always easy to arrange for this, but if it can be done the advantage is great. It is to be hoped that the possibilities of electricity supply in villages will receive more consideration than they have in the past, as they should open up a large field for electrical material of all kinds.

Shipping Exhibition.—We have received a copy of the Official Bulletin and Prospectus of this exhibition, which takes place at Olympia next September. It contains a list of exhibitors and photographs of some of the intended exhibits.

THE LIABILITY OF ELECTRICAL CONTRACTORS AND SUPPLY AUTHORITIES FOR ACCIDENTS.

[FROM OUR LEGAL CONTRIBUTOR.]

From time to time cases occur in which responsibility for accidents is sought to be placed upon electrical contractors and supply authorities responsible for installations. If, in the case of a contractor, it is manifest that the accident has arisen owing to the carelessness of those who work or operate the plant after it is taken over, the claim is easily disposed of; but more difficult questions arise if it is alleged that a defect in construction or design has been the cause of disaster. With regard to the supply authorities, whether they are local authorities or companies different considerations apply. The trouble which is so often occasioned by accidents through alleged short-circuiting, not unnaturally leads to consideration of the legal position. What is the legal liability of the electrical contractor who has installed the plant? If it can be shown that a disaster has happened owing to defective insulation, can the blame be attached to those who put in the plant?

Assume, for instance, that cables have been laid in a place where they are necessarily exposed to injury, as in a coal mine. Given all the conditions as to danger of short-circuiting being brought about owing to cables being worn and frayed by the traffic and work of the mine, it is for the electrical engineer, who has charge of the job, to see that risk is reduced to a minimum. At the same time it is clear that, having regard to the great risk of breakages below ground, no firm would guarantee that a short-circuit would be a thing impossible. What we desire to see is where the liability of the electrical contractor ends under the conditions which usually obtain.

Let us examine, in the first place, the Form of Model General Conditions for Electricity Works Contracts which have been approved by the Institution of Electrical Engineers with a view to seeing whether, if those conditions form the basis of the contract, any liability rests with the contractors after the conclusion of the work. Clause 31 of these conditions provides that:—

"The contractor shall properly cover up and protect such of the work as may be liable to sustain injury by exposure. He shall also take every necessary, proper, timely and useful precaution against accident or injury to the plant, and shall be and remain answerable and liable for all losses, damages or injury which, during the progress of the work, and until it be taken over, may arise or be occasioned by the acts or omissions of the contractor or his servants, but not for any subsequent consequential loss or damage, nor for any breakage or injury, wholly or partially caused by, or arising from, the acts or purchasers of others, or due to circumstances over which the contractor has no control . ."

The clause also provides that, until the plant has been taken over, the contractor shall indemnify the purchaser from all claims under the Workmen's Compensation Act, 1906.

It will be seen that howsoever this clause protects the owner until the completion of the works, it affords him no protection after that time. The period of liability is further defined by Clause 45, which relates to "Maintenance." It is there provided that:—

"Until the final certificate shall have been issued, the contractor shall be responsible for any defects that may develop under normal and proper use, arising from bad materials, design, or workmanship in the works. When called upon, in writing, by the engineer to remedy such defects, the contractor

shall do so with due diligence, and unless such defects be remedied by the contractor within a reasonable time, the contractor shall be responsible for all losses and damages sustained by the purchasers through such defects."

Consideration of these two clauses shows that, if the common form of contract be adopted, the liability of the contractor practically comes to an end when he finishes a job; and even during that period he is not to be liable for the consequences of any accident for which he is not responsible. A fall of roof, for instance, which caused the break of a cable and a short circuit, would impose no liability upon him. No electrical firm could be induced to sign a contract which made them insurers of the work for all time.

We are unable to quote any cases which deal directly with the liability of electrical contractors who have been bound by clauses similar to those above set forth. Nor has the question of liability been considered in any cases which bear very directly on the point under discussion. This absence of authority is, to a large extent, accounted for by the fact that any disputes which do arise are heard behind the closed doors of an arbitration court.

One point, however, is clear, namely, that in employing a firm of electrical engineers to scheme out an installation, the owners or lessees of a mine must necessarily leave something to the judgment of those who are familiar with the vagaries of electricity; and people cannot be held liable for the consequences of a mere error in judgment. In one case (Fulham Borough Council v. National Electric Co., 1906, 70 J.P., 55) a contract for the installation of electric light in a building to be used for the purposes of baths and wash-houses provides (*inter alia*) "that the whole of the work is to be carried out in accordance with the existing rules as framed by the Phœnix Fire Office." No. 5 of these rules provides that: "Where a system of metal tubes is employed, the metal tubes should be earthed, except in those cases where earthing would not be desirable." A system of metal tubes was employed for the work, and in consequence of such tubes not being earthed, a bather received an electric shock which caused his death. The local authority, which owned the baths, paid damages in respect of the death, and sought an indemnity from the contractors. In the proceedings against the contractors, the arbitrator found that earthing the tubes would not have been desirable so far as the risk of fire was concerned, but would in fact have been desirable so far as risk of accident to bathers was concerned. It was held that there had been no breach of contract, and that therefore the wiring contractors were not liable. The lesson taught by this case is that, in drawing up a contract, the first consideration should be the safety of the men working in the mine. Electrical contractors might well be put upon such terms that safety of life and limb would be considered before cheapness of construction.

It remains to consider whether there is any limit to the liability of the mine-owner for the consequences of an explosion which has been caused by a short-circuit. With regard to the pitmen themselves, their right to prefer claims under the Workmen's Compensation Act is absolutely clear. The accident would arise out of, and in the course of, the employment. Again, it might easily be said that the accident was caused by a "defect in the ways, works, machinery, or plant," for which the employers would be liable under the Employers' Liability Act. It is to be observed, however, that there is a section in the Workmen's Compensation Act by virtue of which the employer, having paid compensation to the men, might seek an indemnity against the electrical contractor. For instance, if the accident took place in circumstances creating a legal liability in the contractor to pay damages to the miner, the miner's employer might have to pay compensation in the first instance, but the electrical contractor could be made to indemnify him.

Thus, suppose that during the execution of the works, the installation was negligently left in such a condition that when the current was switched on a short-circuit occurred, and a miner was injured; he could claim damages from the electrical contractor. This liability is based upon the well-known case of Heaven v. Pender, 11 Q.B.D. 503, where it was laid down that: "Whenever one person is by circumstances placed in such a position with regard to another, that everyone of ordinary sense who did think would at once recognise that if he did not use ordinary care and skill in his own conduct with regard to those circumstances, he would cause danger of injury to the other person, or property of the other, a duty arises to use ordinary care and skill to avoid such danger." Application of this principle will relieve the owner during the time the contractors are executing the work; but, as we have seen, it would afford no protection after his liability to maintain came to an end.

The conclusion, then, to which one is driven by the consideration of so much of the law of England as is applicable to the facts, is that the electrical contractor is in no sense an insurer. His liability practically ceases when he leaves the job.

In the case of a local authority or company supplying electricity, different considerations apply.

In the case of an accident caused by their employment of electricity, they may be liable even in the absence of negligence, notwithstanding the general principle that those carrying on statutory undertakings are not usually liable unless negligence be proved (Midwood v. Manchester Corporation (1905) 2 K.B. 597).

For instance, a case which was heard in 1910 by Mr. Justice Grantham indicated the serious liabilities imposed upon electrical companies who allow live wires to remain in disused premises. The facts may be very briefly stated.

It appears that the plaintiff was a builder and contractor, and was, in April, 1909, engaged in rebuilding a house, 32, Devonshire Place. In the course of his work he cut with a chisel into a piece of lead piping in a cellar, which was, according to his evidence, hanging down from the ceiling and which he took to be a gas or water pipe. It was, in fact, a pipe containing a live electric light wire, which had been left by the defendants when they had disconnected the consumer's installation some time previously. The result was a severe shock and burning owing to the fusing of the chisel and cable, and it was alleged that the plaintiff was completely incapacitated for over six months, and permanent injury had been caused. The defendants maintained that the cable had been properly disconnected by withdrawing the fuses of the cut-outs and removing the leads connecting the cut-outs with the installation, the cut-outs being left properly sealed up and insulated, and the pipe attached by wall-hooks to the wall. They claimed that the pipe was their own property, with which the plaintiff had no business to tamper; but it was maintained for the plaintiff that, having received orders to disconnect the service, the defendants had no right to keep a live wire on the premises. The defendants alleged negligence on the plaintiff's part, as the presence of the cable and sealed cut-outs should have given him warning of possible danger, but the plaintiff said that he did not see the sealed cut-outs, as they were hidden under some rubbish. It appeared that the plaintiff's foreman had told the defendant's engineer, before the disconnection took place, that, though the house was coming down, the cellar was not going to be touched, and that it was in consequence of this that the live wire was left on the premises. After hearing the case, the jury found a

verdict for the plaintiff, and assessed the damages at £450 for loss of business, £75 for pain and suffering, and £56 for special damages.

This apparently amounts to a decision that if a supply authority have received orders to disconnect any premises they may not leave any live wires on the premises; or that if they do so, they do so at their own risk.

The principle that persons supplying electricity shall always be made liable applies generally in the colonies and dependencies. We recall a case of two years ago in which heavy damages were recovered in Newcastle, Australia. The action was brought to recover the sum of £2,000 as compensation for severe injuries sustained by plaintiff through coming into contact with live electric wires. He averred that the accident was caused by the careless and negligent method in which the council had erected and maintained the wires in question. The first count of the plaintiff's declaration charged defendant with being guilty of a public nuisance, and the second alleged that the council was negligent in the way stated. It appeared that the council put up certain live wires, along which it conducted electric currents, and it was said that the way in which that was done constituted a public danger and nuisance. Then, the council was grossly negligent in the way in which it maintained the installation. The accident out of which the action arose occurred on a balcony. The balcony was covered by a corrugated-iron roof; one wire was carried about two feet above this roof, and the other five feet above it. The wires were then stretched across the street to the opposite building, and this method of installation had apparently been in existence for some years, though the system had since been altered in such a way that nobody was likely to be injured by the electric current. On the 19th of January of last year, plaintiff had been instructed to make some repairs to the roof of the balcony. He was quite ignorant that the wires were "live," but he endeavoured to avoid contact with them. One of his men was working about the centre of the balcony, and plaintiff stooped down to give him instructions. Upon straightening himself up immediately afterwards, he received an electric shock and became unconscious. A message was at once sent to the electrical depôt, and the current being cut off, plaintiff was released. He was not dead, and was conveyed to the hospital, where he remained for five months. It was alleged that the Council had no right to place these wires in a position where they might come into contact with anyone, and by doing so it was guilty of creating what in law was a nuisance. The council could have placed the wires at such a height as to be out of the way of anyone working underneath them, and they should have been insulated so as to minimise the danger of installation. Apparently the wires had been originally insulated, but had been allowed to get into such a state of disrepair as to become dangerous. In the event the jury awarded the plaintiff £1,275.

WORDS TO THE WISE—AND OTHERS.

By "COMMERCIAL."

Most business people to-day will admit that the fashion of the times in regard to methods in business has been set to no small extent by our cousins in the United States. American "hustle" has become a by-word in the world's work, and the Americans have the most up-to-date methods in every department of commercial activity. Their machines, no less than their systems, are the products of the finest brains which they can command, and there is little doubt that the Americans produce the desired results. As always happens, one finds the extreme, not altogether desirable, which comes with exaggerated "hustling"; the extreme which defeats itself and lays open to ridicule those who go to such extreme. And we in Europe have, in a measure, become inoculated with modern ideas of "getting there," and in books and newspapers we have been told that there was a danger of our becoming "back numbers." (The Americanisms will perhaps under the circumstances be pardoned.)

As a result of this competition, in part, and by reason also of other influences nearer home, no matter what business one belongs to nowadays, the methods of manufacturers, office routine, and the business of advertisement, are all, or nearly all, brought right into line. Labour-saving devices are rampant, from automatic stamp machines to moving staircases, and we pride ourselves that this is indeed a strenuous age. Writers often call it "Modern stress," or something similar. Those who are faddists or extremists in this matter, label their office walls with such devices as, "Time is Money," or "Do it now," or "This is my busy day." They distribute small tracts to their employés, containing short sermons of the "Get on, or Get out" variety, and impress upon the recipients the importance of acting upon the advice contained in the said pamphlets. Doubtless the new methods are a vast improvement in many cases upon the ancient ones, and business increases and dividends grow. Workers of all ranks ought to be more efficient to-day than ever, other things being equal. Incidentally we ought really to be able to work shorter hours, but this is not done in many cases. Improved and more general education, coupled with modern systems, has naturally had a great influence in the business world, and nobody can fail to profit by these influences if they use the present opportunities wisely.

At the same time, in ordinary everyday experience with any business firm, one cannot help seeing little indications of the fact that some fall behind, even when they are most earnestly endeavouring to keep in front. Others are far behind the standards of usefulness to which modern education is supposed to bring them. We hear of a daily newspaper offering prizes for the best applications for a certain vacant situation in this or that business house. The offer is prompted solely by the fact that employers allege that they receive very few really adequately expressed and properly written applications. The employers complain of a lack of the sense of proportion in the candidates, as to the importance of things which matter, and those which do not. If these statements are true, and there is little doubt that they are, workers should not be surprised at the prevailing level of wages, and certainly they are not using all their advantages wisely.

Again, one receives an order from a large electrical firm, accompanied by an inquiry as to when the customer may expect the goods. Now presumably the price was as low as others, or the order would not have come. The goods are promised by a certain date—a fair and reasonable time. Then the buyer threatens to cancel if the delivery is not improved. "Very well," he is told, "cancel it, we cannot do better." He does not cancel, however, because he must have the stuff, and could hardly get it cheaper or quicker elsewhere. The action of threatening to cancel may be smart, but it is not business-like always to use such bluff.

Another order is placed to deliver in fourteen days, as promised. The day following, the buyer inquires if the goods can catch a boat in three days. Such an inquiry is absurd, and a waste of time and money. As if one would say fourteen days for that which can be done in three or four days! Yet these are people who are in business.

An American firm we are told can build a motor

car in half an hour. We should not expect them to stock only sufficient sparking plugs to last just a few days, yet there are English factories which depend upon hand to mouth methods for supplies of equally important accessories.

Another illustration from the opposite side. A dynamo factory orders raw material, and receives a promise of delivery. This delivery is not kept, and subsequently two further promises are made and broken in the same manner. The goods remain undelivered after three promises, and the only reason for the delay is lack of system. It is worse than useless to promise a job, file away the letter copy, and forget all about it, until the buyer complains. To repeat this cycle of operations twice afterwards is beyond all sense or reason. It is done regularly, none the less.

Buyers would do well to state on their orders, in addition to the exact description of the goods, price, etc., the time by which they are required, in those cases where a definite date is in view. Especially does this apply to short delivery dates, since if no time is mentioned, the order takes its turn in company with others. Should a short date be named it is necessary to push the job through, therefore it saves trouble to name the date.

In the same way it is not fair to rush people for goods which are not to be used for some considerable time. Apart from the question of the capital which may be locked up in such material, while awaiting delivery instructions, the manufacturer often finds it difficult to keep to time, with such orders as are really urgent.

A more serious and, it is to be feared, more general, defect in workers than any of the foregoing, is the prevalence of the liability to error. We hear people say that men who make no mistakes, never make anything, but some there are who never make much else but mistakes. No one is infallible, and the opportunity for errors is great; but one thing must be lacking from an otherwise capable person, when he makes these mistakes regularly. That is concentration; and if that quality took the place now allotted by many to mere hustling, we should have greater freedom from error. All the above matters may appear on the surface as trifling, yet they make a considerable difference when they occur frequently. A little forethought obviates, on occasion, much unnecessary trouble.

TRADE STATISTICS OF SPAIN.

The figures given below show the imports of electrical and similar goods into Spain during the year 1912, according to the official statistics recently issued. It will be observed that there is a predominance of German trade in practically every branch. The figures for 1911 are given for purposes of comparison, and notes of increases and decreases have been added:—

Dynamos, electric motors, induction coils, resistances, transformers, etc., up to 400 kg. weight.—

	1911. Pesetas.	1912. Pesetas.	Inc. or dec. Pesetas.
From Germany ...	3,173,000	3,692,000	+ 519,000
,, France ...	453,000	638,000	+ 185,000
,, Great Britain ...	324,000	568,000	+ 244,000
,, Switzerland ...	177,000	106,000	− 71,000
,, Other countries	174,000	453,000	+ 279,000
Total ...	4,301,000	5,457,000	+1,156,000

Ditto, weighing from 401 to 2,500 kg.—

From Germany ...	2,278,000	3,054,000	+ 776,000
,, France ...	240,000	299,000	+ 59,000
,, Great Britain ...	333,000	430,000	+ 97,000
,, Switzerland ...	187,000	281,000	+ 94,000
,, Other countries	145,000	552,000*	+ 407,000
Total ...	3,183,000	4,616,000	+1,433,000

* U.S.A., 397,000.

	1911. Pesetas.	1912. Pesetas.	Inc. or dec. Pesetas.
Ditto, weighing from 2,501 to 5,000 kg.—			
From Germany ...	545,000	496,000	− 49,000
,, Switzerland ...	231,000	237,000	+ 6,000
,, Other countries	62,000	374,000†	+ 312,000
Total ...	838,000	1,107,000	+ 269,000

† Great Britain, 198,000

Ditto, weighing more than 5,000 kg.—			
From Germany ...	3,065,000	4,026,000	+ 961,000
,, France ...	142,000	189,000	+ 47,000
,, Great Britain ...	194,000	165,000	− 29,000
,, Switzerland ...	542,000	373,000	− 169,000
,, Other countries	17,000	320,000	+ 303,000
Total ...	3,960,000	5,073,000	+1,113,000
Accumulators and electric batteries.—			
From Germany ...	113,000	104,000	− 9,000
,, France ...	46,000	79,000	+ 33,000
,, Great Britain ...	8,000	7,000	− 1,000
,, Other countries	20,000	30,000	+ 10,000
Total ...	187,000	220,000	+ 33,000
Cables and wires for electricity, with or without insulating material, of 1 cm. dia. or more.—			
From Germany ...	1,381,000	1,151,000	− 230,000
,, Great Britain ...	18,000	645,000	+ 627,000
,, Other countries	74,000	249,000	+ 175,000
Total ...	1,473,000	2,045,000	+ 572,000
Ditto, less than 1 cm, in dia.—			
From Germany ...	135,000	122,000	− 13,000
,, France ...	78,000	74,000	− 4,000
,, Great Britain ...	20,000	384,000	+ 364,000
,, Other countries	16,000	14,000	− 2,000
Total ...	249,000	594,000	+ 345,000
Telegraph and telephone apparatus, electric meters and parts.—			
From Germany ...	1,106,000	1,122,000	+ 16,000
,, Belgium ...	123,000	77,000	− 46,000
,, France ...	259,000	324,000	+ 65,000
,, Great Britain ...	166,000	204,000	+ 38,000
,, Sweden ...	97,000	119,000	+ 22,000
,, Other countries	37,000	120,000	+ 83,000
Total ...	1,788,000	1,966,000	+ 178,000
Arc lamps.—			
From Germany ...	150,000	157,000	+ 7,000
,, France ...	30,000	25,000	− 5,000
,, Great Britain ...	18,000	10,000	− 8,000
,, Other countries	11,000	10,000	− 1,000
Total ...	209,000	202,000	− 7,000
Carbons for arc lamps.—			
From Germany ...	103,000	94,000	− 9,000
,, France ...	22,000	22,000	—
,, Great Britain ...	5,000	3,000	− 2,000
,, Other countries	3,000	4,000	+ 1,000
Total ...	133,000	123,000	− 10,000
Electrodes.—			
From Germany ...	35,000	19,000	− 16,000
,, Italy ...	34,000	55,000	+ 21,000
,, Other countries	14,000	16,000	+ 2,000
Total ...	83,000	90,000	+ 7,000
Incandescent electric lamps mounted.—			
From Germany ...	3,348,000	4,733,000	+1,385,000
,, France ...	152,000	158,000	+ 6,000
,, Great Britain ...	60,000	334,000	+ 274,000
,, Ohter countries	173,000	566,000*	+ 393,000
Total ...	3,733,000	5,791,000	+2,058,000

* Austria, 466,000

Ditto, unmounted.—			
From Germany ...	8,000	—	− 8,000
,, France ...	1,000	—	− 1,000
,, Other countries	1,000	—	− 1,000
Total ...	10,000	—	− 10,000
Hydraulic motors.—			
From Germany ...	1,192,000	1,135,000	− 57,000
,, France ...	134,000	127,000	− 7,000
,, Great Britain ...	92,000	7,000	− 85,000
,, Switzerland ...	110,000	278,000	+ 168,000
,, Other countries	13,000	16,000	+ 3,000
Total ...	1,541,000	1,563,000	+ 22,000

	1911. Pesetas.	1912. Pesetas.	Inc. or dec. Pesetas.
Steam and gas engines, fixed.—			
From Germany ...	1,018,000	1,300,000	+ 282,000
,, Great Britain ...	857,000	762,000	− 95,000
,, France ...	184,000	288,000	+ 104,000
,, Belgium ...	175,000	226,000	+ 51,000
,, Other countries	105,000	180,000	+ 75,000
Total ...	2,339,000	2,756,000	+ 417,000
Cylindrical steam boilers.—			
From Germany ...	483,000	329,000	− 154,000
,, Great Britain ...	696,000	500,000	− 196,000
,, France ...	189,000	63,000	− 126,000
,, Belgium ...	122,000	71,000	− 51,000
,, Other countries	14,000	25,000	+ 11,000
Total ...	1,504,000	988,000	− 516,000
Multitubular boilers.—			
From Great Britain...	2,062,000	2,944,000	+ 882,000
,, Germany ...	629,000	652,000	+ 23,000
,, Belgium ...	181,000	165,000	− 16,000
,, France ...	285,000	633,000	+ 348,000
,, Other countries	26,000	168,000	+ 142,000
Total ...	3,183,000	4,562,000	+1,379,000

Note.—25 pesetas = £1.

ELECTRICAL TRADE IN INDIA.

Developments in Simla.

The American Government have issued a report by a Special Commissioner, who has recently been touring in India on the possibilities of trade in electrical appliances in Simla. In the course of this report the Commissioner states that in proportion to its population Simla, the summer capital of India and the brilliant social centre of Southern Asia, situated at over 7,000 ft. elevation in the Himalaya Mountains, promises to become the most important market in India for electrical appliances. Since August 1st, 1913, when a water power installation of about 500 KW. became available for public purposes, in addition to private installations already existing at the Viceregal Lodge and the official residences of the Lieutenant-Governor of the Punjab, the Commander-in-Chief of the India Army and the United Service Club, the demand for electrical energy for house lighting and power in Simla has to such an extent exceeded what was anticipated, that the municipal committee has already had to consider whether the existing plant should be increased in the immediate future. When all the more urgent demands are supplied, probably this year the existing plant will not suffice for any of the further demands which will almost inevitably be made as the use of electric lighting spreads to private houses.

Under the schedule of rates which has been announced by the Simla municipality, electricity will be cheaper in Simla than in any other part of India; in fact, it is anticipated that it would be cheaper in Simla to use electricity than kerosene oil. Owing to the many different purposes for which electricity will be required, and the many different types of consumers, it has been considered advisable by the municipality to adopt several alternative tariffs, each of which is best suited for certain types of consumers. One is a statutory flat-rate system which will be employed by consumers who wish to have their supplies metered, and amounts to 2d. per unit for motive power only, and a rate of 1d. per unit, subject to a discount of 25 per cent. during November, December, January and February, for heating and cooking only, and 4d. per unit for all other purposes, together with a charge of 1s. 4d. per month for meter hire. Another rate is for small lighting consumers requiring not more than five lamps, who will use electricity for lighting purposes only, and consists of a charge of 1s. per 30-watt lamp installed, or equivalent per month. Another rate is for domestic and residential consumers who wish to use electricity for general purposes, such as electric irons, kettles, lighting and heating. This amounts to 33s. 6d. per KW. per month for all purposes for domestic use up to 2½ KW. only, except during November, December, January and February, when the limit is raised to 5 KW. These rates are subject to 50 per cent. discount during the four months named. The reduced prices and increased limits for use of electric current in winter are due to the population of Simla being reduced during this season to about one-half of what it is during the summer months.

In a pamphlet which the Simla municipality has recently issued, it is mentioned that electrical energy can now be used for so many varying purposes that it is anticipated that it will eventually displace many of the existing methods at present in vogue in Simla for heating, water-boiling, ironing, cooking, motive power, &c.

The pamphlet enters very fully into the household uses of electricity and the apparatus therefor—vacuum cleaners, electric angethis (which completely replace the ordinary Indian charcoal angethi, but have many advantages over the charcoal angethis, enabling them to be used in addition for purposes for which the charcoal angethi is distinctly dangerous, owing to the noxious fumes given off), electric irons, fans, hand-drills, water boilers, &c.

For construction of wiring systems on consumers' premises, the Simla municipality has approved of certain contractors and electrical engineers who may make their own arrangements with customers. These firms, therefore, will doubtless handle all the Simla business in connection with electric supply extensions. They expect also to do a very large business in the sale of electrical appliances. In conversation with the manager of one of these firms, it was suggested that all kinds of electrical appliances and novelties, especially in connection with heating, would doubtless find a good market in Simla. Owing to the high elevation of the city and its proximity to the Himalayas, the climate even in the summer, may require, at least in the evenings, the use of heating appliances. It will not be until the spring that all the extensions will be completed, so that most residences can be provided with electric current, but even now there is large inquiry concerning electrical appliances.

It is anticipated that it will cost less to heat a Simla house with electricity than with either wood, coal, or kerosene oil. For smaller houses, in order to lessen fire risks, the voltage will be brought down by transformers from 220 to 110 volts, so that replacements for heating of 220 and 110 volts will be required. The municipality will supply alternating current in all cases at a frequency of 50 cycles per second and at the following pressures:—Single-phase low pressure, 220 volts; three-phase low pressure, 380 volts between phases; three-phase high pressure, 2,200 volts between phases. Except in special cases, demands for connections up to 2½ KW. will be supplied from one phase only. Above 2½ KW. consuming devices must be divided into two or more approximately balanced circuits and will be supplied from more than one phase.

It was mentioned that among the native population the electric appliances known as angethis would be in specially great demand for heating and simple cooking; these should be equipped with quartz element disks in the middle, which could be turned in a stand up and down. The stands ought not to be over 6 in. high, for the reason that the natives do not sit on chairs, but squat on the floor, so that higher than a few inches would be inconvenient for resting the feet. Three kinds of lamps are now on the market at Simla—Osrams, Mazdas and Wotans.

The Simla hydro-electric scheme, which makes possible the large use of electrical appliance at this summer capital of the Indian Empire, and which was completed, except for house extensions and connections, on August 1st, 1913, has been carried out for the dual purpose of supplying electric light and energy, and of furnishing energy for pumping water to augment the present supply.

The requisite power is being obtained by taking water from the Nauti, a tributary stream of the River Sutlej, and by leading this water down an open concrete flume to the turbines and generators. In order to divert the water of Nauti into the flume, a weir has been constructed across the stream, with its crest 2 ft above the general bed level of the stream. The weir is constructed of galvanised iron wire crates, averaging about 5 × 5 × 5 ft. each, which are filled with bowlders, and are placed in a trench across the stream about 15 ft. below bed level.

On the bowlder crates the weir proper has been made of concrete, faced with cut stone in cement, and over this weir all floods will pass while diverting the ordinary low water flow into the flume head. As extraordinarily dangerous ground was met in the hillside immediately below the intake chamber, it was here found necessary to tunnel straight through this into the hillside and come out some 800 ft. downstream, clear of floods and bad ground. The concrete flume proper here commences. This flume is 4 ft. × 2 ft., and it winds along the hillside at a slope of 1 in 1,000 for about 1 mile, where it pierces through a promontory by a tunnel 7 ft. × 6 ft. cut out of the solid rock. This tunnel gave great trouble during construction, owing to the lack of skilled labour and the difficulty in getting down suitable drilling plant to the inaccessible spot where it is situated.

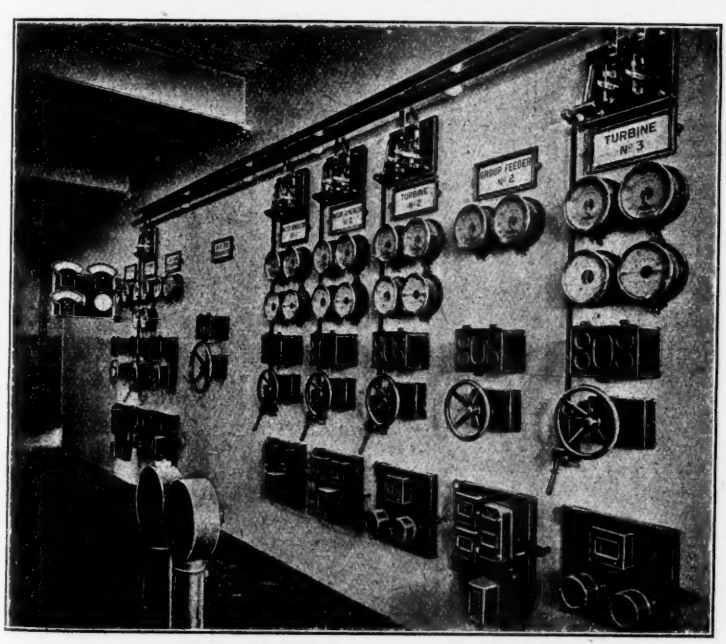
After emerging from this tunnel the flow continues in the open flume for about another mile to a large reservoir to hold an eight hours' full working supply of 6,250,000 gallons, which has been constructed on a suitable spur. The flume where it crosses a small creek called the Jaori, passes through a reinforced concrete box girder of 30 ft. clear span resting on dry stone masonry abutments, and it is also covered over in places where it has been considered that the hillside above was dangerous and likely to slip. Three settling tanks, provided with suitable parabolic scour outlets, have been constructed at intervals along the flume line to intercept all silt which might be brought down with the water, and in the large storage reservoir arrangements are provided for scouring out the silt. Also at certain selected spots where the hillside permits, overflows have been provided which would come into action if the flume were damaged and blocked in any way.

From the flume-proper terminus at the storage reservoir the water is led to the head of the penstock pipes through a reinforced concrete pipe, 40 in. in diameter, which is buried in a track about 1,000 ft. long. At the end of this pipe the headstock chamber is constructed, and out of this the six steel penstock pipes, 16 in. in diameter, lead down to the power-house, which is 545 ft. below.

The power house is designed in two complete halves, and also so arranged as to permit an extension being added to it when required, but at present only three out of six machines have been installed. Each half of the power station will contain three Pelton wheels, coupled direct to a three-phase alternator of 250-KW. capacity, at a

speed of 500 R.P.M., a voltage of 2,200 volts between phases, and a frequency of 50 cycles per second. These alternators are excited by two direct-coupled exciters, mounted on the ends of the shafts of the two centre machines for starting operations, and also from a separate motor-driven exciter set. Power is conveyed from each alternator to the power house switchboard through three-phase rubber cables, and from the bus-bars power will be taken through oil-switch panels to a set of three 250-KW. single-phase, step-up, oil-cooled transformers, which will be situated in a separate transformer room, where the voltage will be stepped to 15,000 volts.

REYROLLE SWITCHGEAR AT WOLVERHAMPTON ELECTRICITY WORKS.



CONTROL WALL, REYROLLE SWITCHGEAR, WOLVERHAMPTON.

The smaller town of Chair, a few miles away, also receives electric power from this system. The transmission line to Simla is about 9 miles long, and the one to Chair is about 12 miles long, while a third line is also being laid from Simla to Chair, 7½ miles long. This system of transmission lines, forming a triangle, has the merit of being able to send current round any two of them should any one of the three be broken. The Chaba-Simla and the Simla-Chair lines are supported on wooden structures, with short spans, while the Chaba-Chair line is supported on steel structures, with spans averaging 1,000 ft., with a maximum of 3,500 ft. All the lines are composed of three copper wires spaced 4 ft. apart in a triangle, and are protected at points where trouble from lightning is anticipated by superimposed steel earth wires. The structures also carry telephone wires, which run to all points where needed. The poles for street lighting will be fitted with one or two tungsten filament lamps, controlled at suitable spots by hand or automatic time switches. These lamps will be of 60 to 80 C.P.

A RECENT ARMOURED SWITCHBOARD.

MODERN armoured switchgear has many advantages when installed in power stations for controlling generating plant, the principal of these being the safety afforded by the complete enclosure of all conductors and the economy effected in buildings and floor space.

The accompanying views, figs. 1 and 2 show a recent example of this apparatus incorporating the above features and supplied to the specification of Mr. S. T. Allen, Chief Engineer and General Manager to the Wolverhampton Corporation Electricity Department, by Messrs. Reyrolle and Co., Ltd., of Hebburn-on-Tyne. In this instance the switchgear is situated behind a wall upon which is mounted the necessary control gear, instruments, etc. The switches are provided with a mechanical remote-control, operated through the wall by means of a hand-wheel.

The gear at present includes panels for controlling three 1,500/3,000-KW. turbine generators (6,600 volts, 50 cycles); two motor-generators; a La Cour converter; and two group feeders.

Two additional panels are about to be added to control a 5,000-KW. turbine generator and a motor-generator.

Duplicate bus-bars are provided, interconnected by a 1,200-ampere non-automatic oil-break switch. Any switch may be readily connected with either bus-bar by inserting plug contacts of the self-aligning circular pin type, into their respective sockets on the switch.

Carriage-type switches are employed with a suitable interlock which, upon the withdrawal of a switch, ensures that the circuit is broken under oil and not on the main or isolating contacts, thus eliminating the possibility of external arcing.

The handlegear closing mechanism is mounted on the switch top-plate casting, and is coupled to the handwheel on the front of the wall by means of a spindle through cut gearing. "Free handle" is obtained in all positions, and the switches may be operated when racked out, for inspection purposes.

In order to successfully deal with the abnormal conditions obtaining on short circuits, very heavy oil tanks are provided and relief valves are fitted to the top plates or covers, the latter being of well ribbed cast steel. For the tanks steel boiler plate is employed with welded joints, the supporting bolts being closely spaced and of ample section; the tanks are lined with wood with partitions between phases. Relief is thus afforded to any internal pressure in the tanks, while a very rapid break at the contacts, under a large head of oil, as far as possible eliminates sustained arcing.

The bus-bars are supported by porcelain insulators in suitably shaped cast-iron enclosures, the latter being filled with high quality insulating compound after assembly.

The cables enter trifurcating boxes below the gear, the boxes being bolted to a chamber which contains the necessary current transformers and sockets for the potential transformer high-tension fuses. The latter transformer is mounted in a case supported in front of openings through which the fuses pass and these are inserted with an insulated handle. The fuse when in position is well protected mechanically by a stout poreclain insulator which completely encloses it and at the same time avoids any exposed connections.

All apparatus is built to jig in order to secure complete interchangeability.

The "control" wall is covered with white tiles and carries all the instruments and apparatus necessary for efficient working.

The generators are excited from common bus-bars, to meet the special requirements of the station, and these bars are mounted on the front of the wall near the ceiling, with the D.P. field switches immediately below. The latter are operated through links by handles beside the main switch handles, with which they are interlocked, thus rendering it impossible to open a field switch with the main switch closed or to close a main switch without first closing the field switch.

Above the main-switch handle is a box with illuminated

coloured windows indicating whether the main switch is "OFF" or "ON" or whether connected to "TOP" or "BOTTOM" bus-bars. The lamps are controlled by suitable switches on the handlegear and the bus-bar label indicator. In the centre chamber of the box are housed the voltmeter and synchronising plug sockets.

A large swing frame hinged to the wall at the extreme end of the board carries the various voltmeters and synchronscopes. The space below the main-switch handle is occupied with a hinged frame upon which the relays (overload and reverse current) time limit, and potential fuse boxes are mounted, thus rendering these items very accessible for inspection testing, etc.

All wiring to the instruments and other fittings on the wall is run through 1¼-in. brass tubing with inspection joints, thus completing the system of armouring; at the same time all wires are easily reached, and for distinction they are of different colours.

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

7,257. "System of duplex wireless or mutiplex wireless telegraphy or telephony." S. D. Williams. March 23rd.

7,266. "Electrical burglar alarms." A. Zehden. March 23rd. (Convention date, March 25th, 1913, Germany.) (Complete.)

7,274. "Electrostatic separators for sorting out the constitutent parts of commodities according to their permeability." A. Bibolini and P. Riboni. March 23rd.

7,298. "Electric lamp sockets." R. B. Benjamin. March 23rd. (Convention date, April 11th, 1913, United States.) (Complete.)

7,311. "Tubular support for electric luminous signs." G. Weissman. March 23rd. (Convention date, March 31st, 1913, France.) (Complete.)

7,318. "Indicators and order telegraphs." A. H. Pollen and H. Isherwood. March 23rd.

7,327. "Apparatus for supervising telephone exchanges working on a semi-automatic system." Siemens & Halske Akt-Ges. March 23rd. (Convention date, March 25th, 1913, Germany.) (Complete.)

7,331. "Telephone Systems." E. A. Graham. March 23rd. (Complete.)

7,336. "Electro-magnetic means for vibrating piano-strings and the like." A. H. Maitre and V. H. G. Martin. March 23rd. (Complete.)

7,342. "Electric motors." E. G. Kennard. March 23rd.

7,416. "Electrical heaters." G. Cooper. March 24th.

7,437. "Apparatus for winding lappings, wire, or the like, upon ring-shaped coils or other bodies of similar shape." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt-Ges., Germany). March 24th. (Complete.)

7,440. "Apparatus for controlling electric or other lighting systems by means of the action of a selenium or other light sensitive cell." C. J. Turner. March 24th.

7,451. "Automatic regulation of electric arcs." E. Girardeau. March 24th. (Convention date, April 1st, 1913, Belgium.) (Complete.)

7,454. "Unspillable valve for portable batteries with liquid electrolyte. G. Pearson and L. Fielder. March 24th.

7,455. "Spring terminal for electric batteries." G. Pearson and L. Fielder. March 24th.

7,462. "Method of and apparatus for indicating or signalling the rise of water level." Vertriebsges. Magnet-Elektrischer Apparate m.b.H. March 24th. (Convention date, May 9th, 1913, Germany.) (Complete.)

7,465. "System of selective electrical distribution." C. F. Kettering and W. A. Chryst. March 24th. (Divided Appln. on 7,545/13.) March 31st. (Convention date, November 20th, 1912, United States.) (Complete.)

7,469. "Reinforced-concrete telegraph or telephone pole." J. Jancso. March 24th.

7,496. "Electric lamps." E. V. Gratze. March 25th.

7,513. "Telephone switches." T. Green. March 25th.

7,542. "Electric Generators for lighting mechanically-propelled vehicles." H. C. H. Smyth. March 25th.

7,544. "Casings for electric cables or pipes conveying illuminating gas or other fluid." H. C. Scharrer and V. G. Frommon. March 25th.

7,548. "Means for and methods of reducing the frequency of an electric current by means of static transformers." A. M. Taylor. March 25th.

7,560. "Process for manufacture of hard compositions of matter from aldehydes and their derivatives and phenols with tars, turpentine oil, and related bodies and other substances." K. Tarassoff. March 25th.

7,562. "Electric Switch." Gustav von Hutschler and A. Ordon. March 25th. (Complete.)

7,566. "Electric driving mechanism for talking machines." E. Kramer. March 25th. (Convention date, April 18th, 1913, Germany.) (Complete.)

7,579. "Electrolytic recovery of zinc from solutions of zinc sulphate." E. J. Hunt and W. T. Gidden. March 25th.

7,586. "Switches for tramways and the like." A. Wilkinson. March 25th. (Complete.)

7,589. "Dynamo-electric generators." J. Stone & Co., Ltd., and A. H. Darker. March 25th.

7,590. "Dynamo-electric machines." J. Stone & Co., Ltd., and A. H. Darker. March 25th.

7,591. "Metal-filament lighting-devices." A-B-C-Schriftlampen G.m.b.H. March 25th. (Convention date, November 20th, 1913, Germany.) (Complete.)

7,618. "Holders of incandescent electric lamps." H. Edwards and J. Phillips, Jun. March 26th.

7,677. "Electric resistances." J. Collinson. March 26th.

7,682. "Incandescent electric lamps." British Thomson-Houston Co., Ltd. (Allgemeine Elektricitats-Ges., Germany). March 26th.

7,684. "Methods of synchronising rotary and cascade converters." Siemens-Schuckertwerke G.m.b.H. March 26th. (Convention date, April 16th, 1913, Germany.) (Complete.)

7,685. "Electric switches." R. Bosch (Firm of). March 26th. (Convention date, February 21st, 1914, Germany.) (Complete.)

7,686. "Connecting devices for the leads from portable secondary batteries." R. Bosch (Firm of). March 26th. (Convention date, June 7th, 1913, Germany.) (Complete.)

7,692. "Contact-breaker device for electromagnetic vibrating members." A. H. Maitre and V. H. G. Martin. March 26th. (Complete.)

7,694. "Self-exciting high-frequency machine. T. B. Thrige. March 26th. (Complete.)

7,696. "Incandescent electric lamps." F. C. Cook. March 26th.

7,699. "Hydrodynamic speed indicators for ships." A. R. Spillemaeker. March 26th. (Complete.)

7,701. "Portable transmitters for wireless telegraphy." L. B. Miller. March 26th.

7,715. "Method of preparing highly magnetic iron and allied metals." F. H. Loring. March 27th.

7,717. "Fool-proof and safety automatic cell-charging switch and holder for recharging accumulators and the like." T. M. Lingard. March 27th.

7,731. "Electrical selective systems." H. G. White and I. H. Parsons. March 27th.

7,746. "Combined dynamo electric generator and electric motor." W. Fox. March 27th.

7,760. "Memorandum boards for use in connection with telephones and the manufacture thereof." J. F. Sessler von Herzinger. March 27th. (Complete.)

7,761. "Method and apparatus for the internal irradiation of the human body by means of rays emanating from a Rontgen-tube or other source. E. Pohl. March 27th. (Convention date, March 29th, 1913, Germany.) (Complete.)

7,766. "Electrical conductors." M. Hochstaedter. March 27th. (Convention date, March 27th, 1913, United States.) (Complete.)

7,772. "Telephones, phonographs and such like apparatus." A. S. Bowley. March 27th.

7,774. "Apparatus for suspending arc lamps and other articles." A. E. Spencer. March 27th.

7,779. "Commutators for dynamo-electric machines." Siemens Bros. Dynamo Works, Ltd. C. P. Bramley and T. A. Wisdom. March 27th. (Complete.)

7,783. "Dynamo-machines." H. Leitner. March 27th.

7,788. "Device for obtaining Rontgen ray exposures." G. Bucky March 27th. (Addition to 2,815/14. Convention date, April 7th, 1913, Germany.) (Complete.)

7,792. "Arc-light carbons." H. Ayrton. March 27th.

7,815. "Electric lamp fittings." J. B. Alexander. March 27th.

7,819. "Plug-and-socket contacts for electric circuits." B. Hopps and Lodge Sparking Plug Co., Ltd. March 27th.

7,821. "Device for subaqueous electrical driving of machines using or generating hydraulic pressure." Signal G.m.b.H. March 27th. (Convention date, March 29th, 1913, Germany.) (Complete.)

7,842. "Electrical heaters." H. S. Martin. March 28th.

7,851. "Electrically-operated cranes and like machinery." E. Holme & Co., Ltd. & E. Holme. March 28th.

7,854. "Electric-light fittings specially applicable to fittings adapted for indirect illumination." Simplex Conduits, Ltd., and L. Maxwell Waterhouse. March 28th.

7,859. "Machines for turning articles made of clay, such as insulators for telegraph purposes, pottery-ware, and the like. W. Podmore. March 28th.

7,868. "Apparatus for diminishing the air friction in electric machines having flywheels." Siemens-Schuckertwerke G.m.b.H. March 28th. (Convention date, March 29th, 1913, Germany.) (Complete.)

7,882. "Electric insulation of rail joints for rail or track circuits on railways or tramways." B. R. Wills and J. C. Sykes. March 28th.

7,884. "Electrical insulation for rail or track circuits for railways or tramways." B. R. Wills and J. C. Sykes. March 28th. (Divided Application on 19,603/13, August 29th.)

7,885. "Electrical insulation." B. R. Wills and J. C. Sykes. March 28th.

7,890. "Use of interrupted current as method of effecting an initial quivering in the vibration of bodies by electricity, more especially the strings of musical instruments such as the piano." A. H. Maitre and V. H. G. Martin. March 28th. (Complete.)

7,900. "Controlling switches for electric circuits." V. E. Joyce and Spagnoletti, Ltd. March 28th.

7,907. "System of operating electric control mechanisms for printing telegraphs and the like." Western Electric Co., Ltd. (Western Electric Co., United States). March 28th. (Complete.)

7,921. "Process of lighting by means of synchronised intermittent electric arc." A. Blondel. March 28th. (Convention date, April 1st, 1913, Belgium.) (Complete.)

7,922. "Microphones especially suitable for use in radio-telephony." A. F. Sykes. March 28th.

7,925. "Electro-deposition of metals." S. O. Cowper-Coles. March 28th.

7,926. "X-ray generators." U. Magini. March 28th. (Complete.)

7,932. "Conversion or transformation of electric current." A. Scherbius. March 28th. (Addition to 24,306/13. Convention date, March 29th, 1913, Germany.) (Complete.)

7,938. "Electric installations, particularly applicable to electric lighting." R. Despessailles. March 28th. (Convention date, March 29th, 1913, Belgium.) (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

22, 375. Electrical Resistances. C. E. Hay and H. W. Sullivan. October 2nd. (March 18th, 1913.)

1913.

3,344. Circuit Arrangements for Junction Lines at Automatic and Semi-Automatic Exchanges. Siemens & Halske Akt. Ges. February 8th. (February 10th, 1912.)

3,431. Circuit Arrangements for Automatic or Semi-Automatic Telephone Systems in which there are Several Lines to a Station or Group of Stations. February 10th. Siemens & Halske Akt. Ges. (February 9th, 1912.)

5,734. Electric Recording Devices. British Thomson-Houston Co. (Allgemeine Elektricitats Ges). March 7th.

5,745. Brush Particularly for use as Sparking-Plug Cleaner. E. Swinney. March 8th.

5,926. Dynamo-Electric Machines. F. Newton and Newton Bros. March 10th

6,136. Methods of Starting the Arcs of Electric Furnaces. E. K. Scott. March 12th.

6,169. Timing Device for use in connection with Electric Switches and for Other Purposes. N. Bendixen and F. C. E. Gondrup. March 12th.

6,186. Electric Train Signalling and Controlling Systems. A. J. Allard. March 12th.

6,369. Telephone Exchange Systems. P. H. Kennedy and J. W. Turner March 14th. (Cognate Application 8,188/13.)

6,602. Electric Battery Lamps. W. E. Bladon. March 17th.

9,986. Selective System of Telephony. R. C. M. Hastings. April 28th.

12,060. Telephone Systems. Siemens & Halske Akt. Ges. May 23rd. (May 25th, 1912.)